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Master's Programme in Information Networks

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Improving user interaction for a content creation web application tool for rock climbing – a case study.

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ABSTRACT OF
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This thesis is a case study on improving user interface interaction for a start-up web application tool used for content creation.

27 Crags is a web-based service for rock climbers for sharing rock climbing destination information around the world. The service provides interactive tools that allow any climber to input information about rock climbing locations and routes on the platform.

The goal of the case study is to enhance the experience of the web application for users who create and edit the content on the service. The current web-app UI is analysed to discover the biggest problem areas that could be improved.

As the first iteration, a low-fidelity paper prototype is constructed with proposals on how the user interface could be improved. The ideas are then developed further and messaged in the next prototype iteration in an interactive high-fidelity prototype. User tests are conducted with the second prototype to validate if the design suggestions solve previously discussed problems and to discover if users would like to use it.

According to the user testing, the suggested improvements to the user interface seem to satisfy the users in multiple ways though there are some features that need further development. The content structure proves to be the most complicated issue as the current and the suggested user flows do not seem to be ideal. However, some of the proposed improvements receive good feedback and would clearly enhance user satisfaction.

Keywords:	user interface design, interaction design, web application, user experience, user research, user testing, user-centred design, prototyping
Language:	English

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DIPLOMITYÖN TIIVISTELMÄ

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Tämä diplomityö on tapaustutkimus käyttöliittymän vuorovaikutuksen parantamisesta sisällön luomiseen käytettävälle verkkosovellustyökalulle.

27 Crags on kalliokiipeilyharrastajille tarkoitettu verkkopohjainen palvelu, jonka kautta käyttäjät voivat jakaa tietoa kiipeilykohteiteista ympäri maailmaa. Palvelu tarjoaa interaktiivisia työkaluja, joiden avulla jokainen kiipeilijä voi syöttää tietoa kalliokiipeilypaikoista ja -reiteistä.

Tapaustutkimuksen tavoitteena on parantaa verkkosovelluksen kokemusta käyttäjille, jotka luovat ja muokkaavat palvelun sisältöä. Nykyistä web-sovelluksen käyttöliittymää analysoidaan, jotta löytyisi suurimpia ongelma-alueita, joita voitaisiin parantaa.

Ensimmäisenä iteraationa rakennetaan karkea paperiprototyyppi, jossa on ehdotuksia siitä, kuinka käyttöliittymää voitaisiin parantaa. Sen jälkeen ideoita jalostetaan ja kehitysehdotukset esitetään seuraavassa iteraatiossa viimeistellymmässä ja interaktiivisessa prototyypissä. Jälkimmäisellä prototyypillä suoritetaan käyttäjätestejä sen varmistamiseksi, ratkaisevatko suunnittelusehdotukset aiemmin mainittuja ongelmia ja samalla selvitetään, onko käyttäjien mielestä prototyypinmukaista sovellusta mielekästä käyttää.

Käyttäjätestauksista selviää, että ehdotetut parannukset käyttöliittymään tyydyttävät monilta osin käyttäjiä, mutta jotkin ominaisuudet näyttävätkin kaipaavan jatkokehitystä. Sisältörakenne osoittautuu monimutkaiseksi aiheeksi, eikä nykyinen tai ehdottu käyttöpolku näytä olevan ihanteellisia. Osa ehdotetuistakehitysehdotuksista saavat kuitenkin hyvää palautetta ja parantaisivat selvästi käyttäjien tyytyväisyyttä.

Asiasanat:	käyttöliittymäsuunnittelu, interaktiosuunnittelu, web-applikaatio, käyttäjäkokemus, käyttäjätutkimus, käyttäjätestaus, käyttäjäkeskeinen suunnittelu, prototypointi
Kieli:	englanti

Glossary of rock climbing terms

Boulder
A large block of rock that has climbing routes on it and is not too tall to be climbed relatively safely without a rope as protection. Instead climbers might carry cushioned pads to soften the climbers fall.

Bouldering
A sub-discipline of rock climbing where boulders are climbed without a rope. Usually, bouldering is done on relatively short cliffs or boulders where falling would not be fatal. Often boulderers carry portable foam mattresses to the base of the climb to make it safe to fall to the ground.

Boulder problem
Like a *route,* boulder problem is a defined passage to ascend a boulder or a rock face but without the need to secure the climb with a climbing rope. Boulder problems, as opposed to climbing routes with ropes, are much shorter and thus can be physically hard. They are called problems because being shorter they often require solving the complexity of finding the easiest body positions to make the ascent possible.

Crag
A cliff or a small area with climbing routes or boulders.

Free climbing
The modern most popular climbing disciplines are mostly based on a purpose to move upwards on rock by grabbing the rock only with human limbs while ropes and technical gear are used only for safety purposes in case of a climber falling. Trad climbing, sport climbing and bouldering differ in the way how climber makes falling safe, but the purpose is to go upwards without any aid of pulling on ropes or other gear.

Hold
A climbing hold in the context of rock climbing is a formation of rock that climbers grab with their hands or push with their feet in order to ascend.

Route
An established passage to ascend rock face. Usually, a route receives a climbing grade to describe the physical difficulty of a route. In some context, route could mean a climb which is usually secured with a climbing rope as opposed to a *boulder problem*.

Sport climbing
A discipline of *free climbing* where climber ascends a cliff with a rope and secures the rope with drilled bolts permanently attached to the wall. The purpose is to ascend the route without weighing the rope but in the case of a fall, the rope would catch the climber. *Sport climbing*, as opposed to *trad climbing* discipline from which it evolved, is very safe thus allowing the climber focus on the physical difficulty of the climbing.

Topo
A graphical representation of a climbing route (Lourens, 2005). Originates from the word *topography*. Quite often *topo* is accompanied with additional info for the route, such as the route name or difficulty grade for the climb. While the *topo* originally means information for a single route, often a guidebook is also referred to as a topo (Pesterfield, 2007).

Trad climbing
Originating from *traditional climbing*, trad climbing is a discipline of free climbing where climber tries to ascend a cliff while securing himself with a rope and detachable gear to the rock face. The gear is put in cracks and rock formations only for the purpose of catching the climber in the case of a fall. The nuts and various devices are later removed so the wall will be clean of any metal after climbing activity.

Other terms

App
In the context of this thesis, app usually refers to a *web application*. The distinction between a dynamic web page and a web application is not well defined but

complex tasks, like content creation and editing on 27 Crags web, are a typical characteristic for a web app.

Modal

A modal window creates a mode that insists on a user response by locking out other parts of the system (Arlov, 1997). Useful design pattern when there is a task that requires immediate focus and action of the user but it can be harmful when used in inappropriate situations (Sebastian, 2018). Modal as a term is used as a shorthand for a modal window which creates a mode where the background is dimmed to guide user focus into the popup window.

Prototype

"A prototype is a simulation of an actual system that can be quickly created." A simple incomplete model or mock-up of a design is a vehicle for exploring, communicate and evaluate designer's ideas. (Galitz, 2007)

UI

User interface. UI in the context of this thesis is specifically a digital user interface.

1 Introduction

This thesis is a case study on improving the web user interface of 27 Crags web service. 27 Crags is a Finnish start-up with a mission to build software tools for documenting rock climbing areas around the world (27 Crags, no date f). Their current platform has a decent number of users and content, but they also recognise some design flaws in their current implementation.

This thesis proposes web user interface enhancements on content creation and delivery parts of their service. The delivered changes are based on user feedback and common design patterns. The end-product of the thesis project is an interactive prototype which is tested for feedback through user testing.

This chapter discusses the motivation and research goals for the study along with the setting and restrictions for the case.

1.1 Motivation

27 Crags acts as a platform for sharing valuable information for climbers. Thus, the information shared on the service is very valuable for the company. Serving relevant information about different rock climbing venues around the world will make the service more appealing to travelling climbers to different climbing destinations. The current business model for 27 Crags is based on income on user subscription fees, advertising banners and climbing venue or travel information advertising visibility. Having more users on the service will raise the number of subscribed users and yield more advertising income.

The content on the 27 Crags is separated into two categories: free to use *community topos* and *premium topos* which are visible only for users who pay for their monthly subscription to the service. A guidebook of a climbing area is called a *topo*, origination from *topography of a route.* Anyone can create community topos but premium topos are better quality content curated with some local climbers of the area. The premium topo contributors get a share of 27 Crags incomes for developing both the climbing area and keeping the content up to date.

Content on the 27 Crags service is the main motivation why rock climbers use the service. According to 27 Crags CEO, they have had some challenges with content creation part of the service. They had some cases where they discussed with a local contributor of a climbing area about developing a premium topo but once the contributor was left with the task of inputting the information on the 27 Crags platform, they never completed the task.

Having a better user interface for creating content on the 27 Crags platform would enhance the experience of content creators. Better UI would also most likely result in enhancing both quantity and quality (accuracy) of the content on the service. Also, a better representation of content could increase satisfaction for users who consume the content on the service.

1.2 Objectives and Scope

The objective of this thesis is to suggest improvements in the graphical user interface according to the needs of the rock climbers using the service. To be more exact about the users, the primary goal is to target the users who create content on the service. This involves methods of creating and maintaining information on rock climbing locations. As a secondary goal, having opportunities to add useful and relevant information on the platform in an easily consumable manner will benefit the larger portion of the user who mainly consumes the information on the platform.

The methods used to attain this goal are user research, prototyping and user testing with a prototype.

- **RQ1:** *What parts of 27 Crags web app topo creators struggle with and how could they be improved?*

- **RQ2:** *What user interface design improvements would enhance usability and user experience for rock climbers using 27 Crags web app?*

The base user research was minimal. 27 Crags CEO described pain points of content creators and what needed to be improved in his perception. The thesis author is a climber himself and has travelled on multiple continents in the

pursuit of climbing activities, so he will also use his knowledge of the climbing domain as a starting point.

To keep the thesis topic compact, few limitations were set. This thesis will not consider any design choices made on the 27 Crags mobile applications on Android or iOS platforms. Also, the focus is restricted to the content creation user flows. However, this will partly intersect content consumption user flows so enhancements content presentation visuals will be proposed as well. Another conscious restriction for the topic was that the initial user research was kept minimal by giving trust and emphasis on how the CEO explained their problems.

Based on this research topic the author will deliver graphical design illustrations and an Invision prototype to 27 Crags.

1.3 Thesis author

The thesis author is a passionate rock climber himself. By the time of writing this thesis, he has been climbing on outdoor rock for over a decade and he has travelled around Europe chasing climbing pursuits. The author has also extensive experience of using the 27 Crags service. As most of the users, the author uses the service mainly for exploring information about outdoor climbing, but he has also made minor contributions to the *community topos*. In addition to the other acquired feedback, the author utilizes also his own experiences of rock climbing and 27 Crags as a regular user of the service. The extensive knowledge of the rock climbing background and knowledge helps to understand the underlying needs and motivations of 27 Crags users.

1.4 Structure of the thesis

Chapter 2 *Background and context* introduces background on what is rock climbing as an activity, what 27 Crags as a company and some literature background used as a support while working on design iterations. Chapter 3 *Problem analysis* discuss problem-areas that could be improved from the current web-app UI. Chapter 4 *Prototypes* introduce an early prototype draft and a more detailed interactive high fidelity prototype which suggest UI. Chapter 5 *User study and*

testing describe user study methods and findings. The last chapter 6 *Discussion* concludes with key findings and results.

2 Background and context

2.1 Rock climbing

People around the world do rock climbing for recreational pursuits. Enthusiastic climbers are willing to travel to experience climbing on varied rock formations. Each climbing area and each route offer unique challenges for a climber.

When climbers travel to new rock climbing destinations, they usually seek out information about the area and its established climbs. Often local climbing pioneers and enthusiasts have published a guidebook about climbing in the region. The guidebook can contain information how to access the cliffs or boulders, what time of year the weather is good for climbing, what are the established routes on a cliff and how difficult they are. Some areas and cliffs are very famous for their good quality climbing and beautiful setting and people travel far distances to experience the climbs.

As a sport, rock climbing is versatile and provides multiple kinds of satisfaction for a climber. Challenges lie in multiple forms. First, climbing requires physical fitness. A climber needs to move his body up the climb. Second, efficient movement requires good technique. Advanced climbers have learned ways to shift their balance and initiate movement in an efficient way to conserve energy. Third, mental focus and mastery are required to cope in challenging situations. The amount of risk varies depending on the climbing discipline but being far above ground is seldom natural for a human.

Climbing is becoming an Olympic sport (International Olympic Committee, 2016), and the sport popularity is arising in both at artificial climbing gyms and at outdoor rock climbing settings (Kuelthau, 2018).

2.2 27 Crags

The Finnish start-up 27 Crags state their mission is to “document all the best boulders and crags all over the world”. They think “knowledge about crags should be documented and shared” and they aim to create the best tools to do it. 27 Crags hopes to become known to the climbing community as the platform for finding climbing information of different areas to enable climbers to have good climbing experiences and successful climbing trips. (27 Crags, no date f)

2.2.1 Content

27 Crags acts as a platform for sharing information about rock climbing locations. The content on the service is often called in climber’s slang as *topos*. Originating from “topographic presentation of a route”, a topo is a graphical representation of a climbing route (Lourens, 2005). However, a guidebook for a climbing area is often referred to as a topo as well. 27 Crags claims they have documented hundreds of thousands of climbing routes and boulder problems across 111 countries on their service and they are one of the world’s largest climbing web sites (27 Crags, no date b).

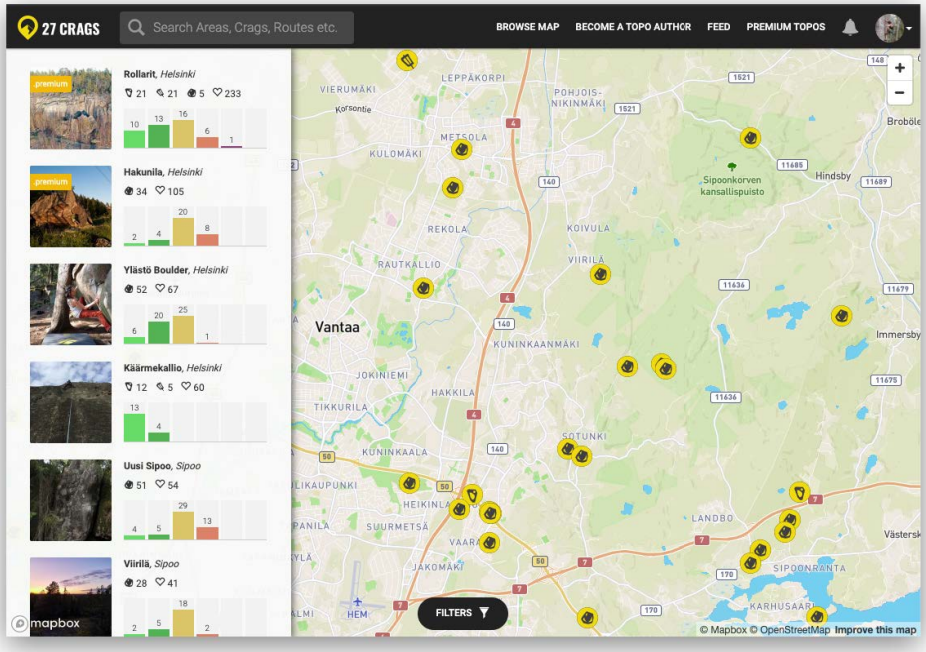

Figure 1: Screenshot of a browse map view zoomed to Sipoonkorpi at Southern Finland in the current web-app (27 Crags, no date d). The figure shows how boulders and crags are displayed on the map along with a listing on the left. Each boulder and crag may contain multiple

separate sectors or boulders depending on the size of the crag and how the climbs have aligned.

The actual content on 27 Crags is organized by separate crag entries, each containing information of the crag such as the location, photos, description, different sectors of the crag and the actual climbing routes. The user may search for different crags and boulders using a search bar or by browsing an interactive map (see **Figure 1** for map view).

Each crag or boulder page is divided into multiple subpages. The overview page is the entry page for the crag. Subpages are topos, map, description, photos and access. Each section serves a purpose for sharing information on the location, how to access the crag and its history, but content-wise the topos section serves the main information about climbing routes and boulder problems.

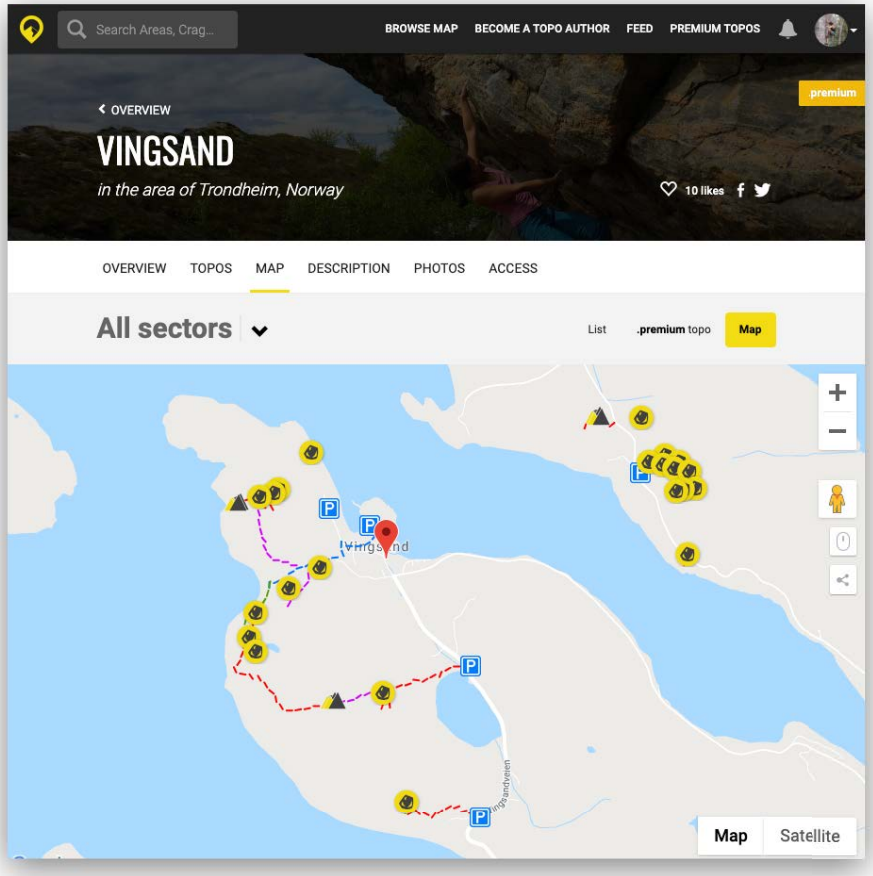

Figure 2: Screenshot for Vingsand crag map view in Norway in the current web-app (27 Crags, no date h). The map shows where to park the car, how the climbing sectors and boulders are aligned and how to approach each sector. Hovering a mice cursor above these elements show extra information such as sector name and how many topo images does it contain.

The topos section can be hierarchically divided into separate climbing sectors of the crag. Each sector contains topo pictures and route information. Dividing a crag into multiple sectors is useful when a crag hosts a vast number of climbs, so it is easier to navigate between different sections of the crag. However, many of the smaller boulders or crags are so small that they may contain only a single sector. On the other extreme, there are some boulder areas that could contain over a hundred separate boulder sectors, each with their unique climbs. **Figure 2** displays how a map view for a boulder crag entry could look like.

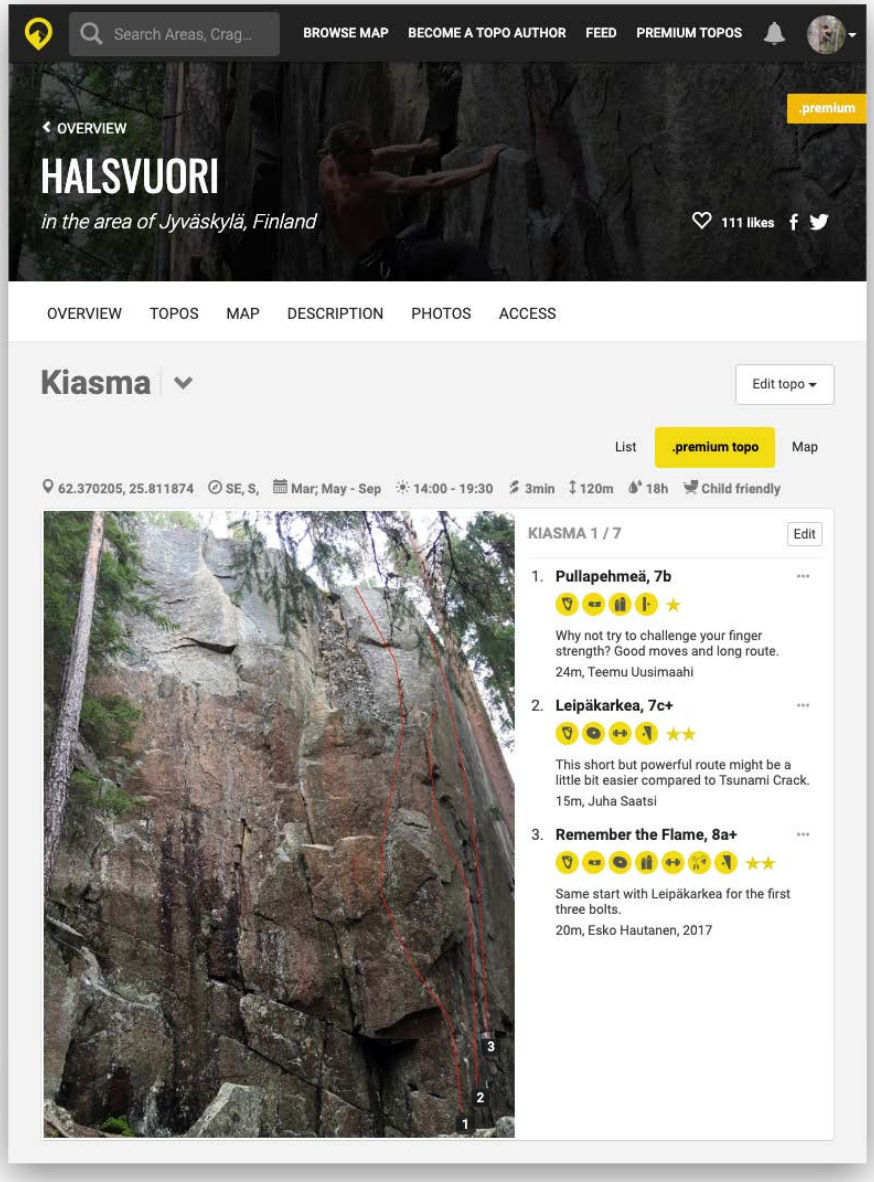

Figure 3: Screenshot of Halsvuori crag topo for Kiasma sector's first topo image in the current web-app (27 Crags, no date e). The figure shows the layout for displaying topo images and how the routes are drawn on it. The three routes drawn on the image are displayed on the side.

Topo pictures are listed vertically on the sector page. The pictures show how the rock looks. See **Figure 3** for an example of how a topo for a sector could look like. The topo author can draw lines on the picture to show how climbs ascend through specific parts of the rock. These lines are climbing routes that someone has ascended before and depending on the style of climb it may be equipped with drilled bolts and could be brushed clean of moss covering the holds, the rock formations which climbers grab with their limbs to ascend.

2.2.2 User groups and motivations

Finding information on about climbing areas is the main motivation for using 27 Crags for most of the users. 27 Crags state their service enables climbers to plan and get the most out of their climbing trip (27 Crags, no date b). As a few examples, local climbers could search for climbing routes in their area using 27 Crags or climbers could plan their next trip by looking up different climbing destinations (27 Crags, no date b).

The main motivation for the users to use 27 Crags is sharing information about rock climbing areas. Within this scope, the motivation can be divided into two: finding information or creating new content. This thesis focuses on the content creation side but some of the proposed changes would also enhance the representation of the content and thus users finding information should also find the proposals pleasant.

Within the content creating user group there are two slightly different motives of inputting content to the service: *premium topo* creators and *community topo* contributors. The premium topo creators have a partnership with 27 Crags. In exchange for creating well-curated and accurate topos of their area, the creator and possibly their community will receive income based on the popularity of the created topo(s). The community topo contributors have no partnership with the service but as a normal user of the service, they have a possibility to correct some misleading or outdated information on the topos.

Enhancements in the user interface will benefit the experience of both content creator groups and would possibly result in a higher amount of content and more accurate or up to date information. However, the visual designs proposed in this

thesis will focus on the premium topo content creators. Having a larger quantity of quality *topo* content on the service will attract more paid users to the service and premium topo content creators are responsible for the quality content.

2.2.3 Business model

Paid user subscriptions and advertising income are the main revenue income for 27 Crags. The motivation for users to pay for the subscription is to get access to the higher quality premium topos (27 Crags, no date a).

Advertisement income consists of general web advertisements shown to users within the topos and climbing related venues. Climbing gyms, gear shops and travel accommodation facilities can purchase visibility on the map view and travel info section of a topo.

The strategy for the company seems they want to raise their revenue by providing more high-quality topos around the world and attracting more climbers to pay for their subscription to the service.

2.3 Literature

There is some literature available for solving some of the problem areas that the 27 Crags user interface also faces. Nielsen (2006) had a case where according to a user testing their customer had a confusing information architecture. Nielsen suggests some actions that could generally work in a similar scenario. Some of the proposed ideas could be utilized in the current case with 27 Crags. One of the actions was that restructuring the site would allow organizing content so that it is easier to understand and navigate. Another possibly useful action was having cross-reference links between sections where the user ends up when having the intention to go to another section. With navigation links to access the correct section, the user could easily correct their mistake and find what they were looking for.

As this case with 27 Crags will aim to improve the user interface of the web-app the heuristics for user interface proposed by Nielsen (1995) may be a useful tool. The third of Nielsen's heuristics is "User control and freedom". Applying the

concepts of having a possibility to undo actions and go backwards in system state the 27 Crags web-app has some interaction issues that need to be solved. In the current web-app, the user needs to bounce between popup menus and modal windows to accomplish special edits and if the user hits a cancel button at some point the user is taken back to the starting position. The seventh of Nielsen's heuristics are labelled as "Flexibility and efficiency of use". The nature of 27 Crags content leads the topo author into performing repetitive actions as the number of routes on a single crag can be high. Nielsen's suggestion of providing *accelerators* for speeding up the expert user's interaction with the system could be useful.

As content editing is one of the focus areas one consideration is what is the best method of providing editor controls in the UI. Rawool (2017) discusses how inline edits can be done in different ways depending on the complexity of the editable content. Rawool suggests that if the user wants to edit inline content in multiple spots having a toggleable edit mode could serve better the users natural flow. Though toggling edit mode on and off introduces extra effort from the user, which can be called as *UI friction*, it might allow the UI to support the user's tasks better. Degani and Laubheimer argue that toggleable modes in systems make them more complex and hinder the discoverability of its functions but such modes might still be useful to enable the user to accomplish complex tasks (Degani, 1996; Laubheimer, 2019).

Newman and Landay (2000) discuss how sketching early design ideas first on paper with low fidelity is a well-adapted and useful practice for UI design. Such sketches allow the designer to explore ideas with a low effort without being hindered by low-level details. These ideas can then be iterated further into more real looking mock-ups or interactive prototypes gradually with more details. Newman and Landay also suggest how drawing a site map help to understand the information structure of the content better.

Design Council (2004) introduces a double diamond model for creative processes. Their suggestion is that the design process could have four different phases: discover, define, develop and deliver. During the discovering and developing phases, the purpose is to expand and explore in a creative way from the current situation and during definind and delivery phases, the purpose is to

narrow down to refine the previous research and exploration into concrete deliverables. In the process of this thesis, the low fidelity paper prototype acted as the first diamond: first as a tool for discovering possibilities but later it is defined into a concrete paper prototype which was used as a tool for conveying ideas. Then the more accurate well defined interactive prototype acted as another diamond. First, there was a possibility to develop ideas further based on what was learned from the first prototype and then the prototype was defined and delivered as an interactive prototype.

3 Problem analysis

This chapter discusses the visual design challenges of the current user interface for 27 Crags. Main topics include content organization and hierarchy, information design and common user interface interaction heuristics.

Through discussions with the 27 Crags CEO and analysis of the current implementation, it seems the biggest challenge is the high variance of content style and volume between separate crag entries. Some crags may contain over a hundred sectors and over a thousand routes while another crag would host a lone boulder with a couple of different boulder problems. Such extreme cases amplify the problems present in the information structure of the current implementation of the app. There must be a sane way for the user to browse and edit the content on each crag.

Another present challenge lies in the way the topo editor has control over the content. The discoverability of editing possibilities within nested menus and bouncing between separate modal windows to edit content might not be ideal.

3.1 Content hierarchy and organization

Some boulder crags, like Magic Wood in Switzerland, may contain over a hundred separate boulders which would mean the crag map view and sector listing are cluttered with an equal number of boulders. Such a massive bouldering area could have over a thousand boulder problems (routes). On the other extreme, it is rather common in rural parts of Finland that established

boulders are few and far apart and each boulder crag would host only a single boulder sector with only a couple of boulder problems.

Information design is about making decisions on how to present information so people can use it or understand it more easily (Garrett, 2003). Having a good content structure is related to good navigation design and information design. Wayfinding is a term describing how users feel while navigating. "Good wayfinding enables users to quickly get a mental picture of where they are, where they can go, and which choices will get them closer to their objectives." (Garrett, 2003). **Figure 4** shows the nested information structure of a crag entry. Good wayfinding would be essential to ensure user would feel confident while navigating towards the routes they are interested in. 27 Crags is a content-oriented service. To make all the information easily accessible and browsable requires a clever information design and structure.

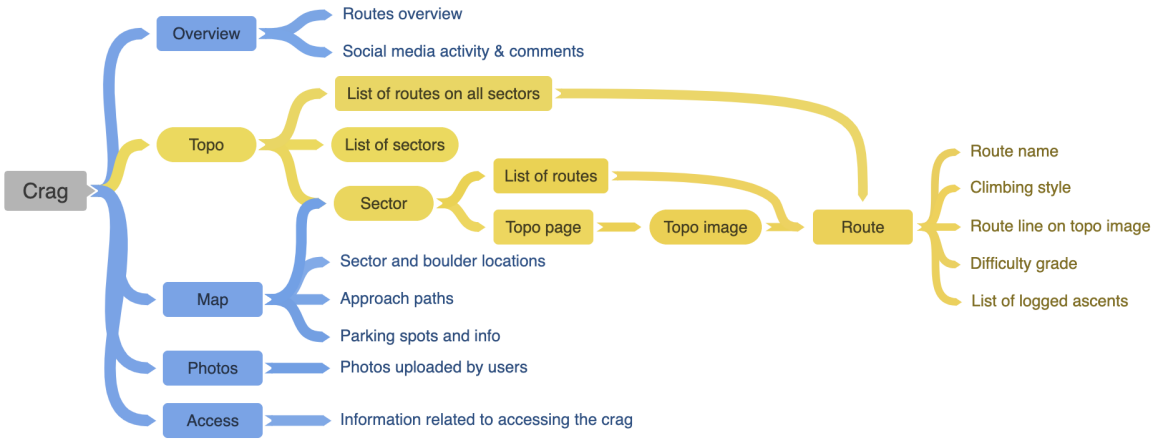

Figure 4: Information and page structure for a single crag entry. Square items on the figure have their own page while others are content items of the hierarchy. The yellow branch shows the main focus of this thesis. The first level of entries is the same as the navigation bar for the crag. The overview page is the entry page for a crag. The topo section has the most complicated content structure and contains the most detailed information.

To improve wayfinding and user browsing experience maybe some of the pages could be improved to improve user understand their position in the information hierarchy. For example, the topo page holds a list of routes for a sector. Having some navigation buttons to adjacent sectors could help the user to browse through multiple sectors. Another example: there could be own page for sectors overview with graphical information instead of just a small drop-down listing shown in **Figure 6** and **7**.

Navigating and organizing the complicated content of topo section is not straightforward. In the current implementation, a user-click on the navigation bar topo item would take the user to the *list of routes on all sectors* page, which is shown in **Figure 5**. Some users might rather expect to land on a page that would show an overview of different sectors. On the other hand, clicking a link *browse topos* on the crag overview page would take the user to the first sector page, but only if the crag is a premium topo. Otherwise, the same button would take to the *list of routes on all sectors* page. Probably not an ideal solution. The long list of all routes provides to be especially problematic when the crag has hundreds of routes. In this situation, the list would probably be useful to the user only once user would use sorting functionality to the list to sort interesting routes to be visible.

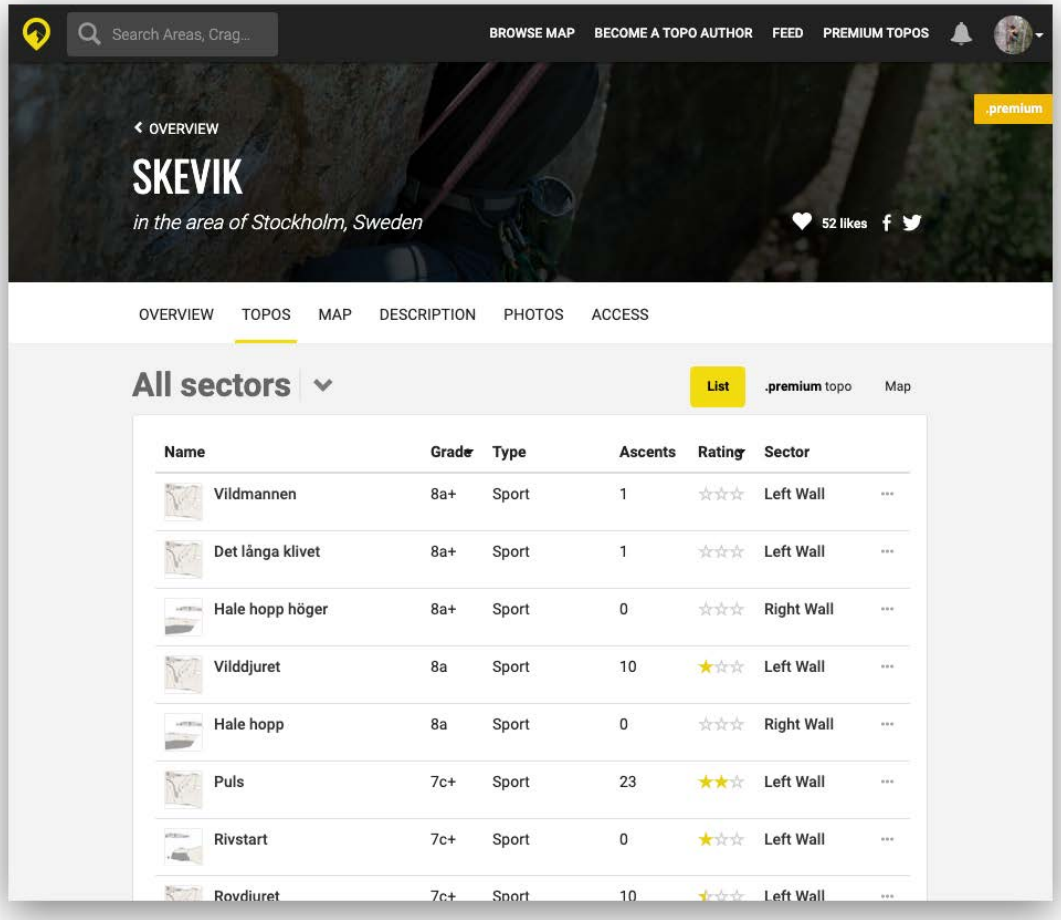

Figure 5: Screenshot from the current web-app showing route listing for all sectors of Skevik crag in Sweden (27 Crags, no date g). This is the page displayed to the user when clicking the topos item in the navigation bar.

Topos are very visual content. Instead of showing a list of a lower-level information object, routes, maybe displaying a higher level of information content, sectors, would enhance the user's wayfinding experience. This would give a better overview and would follow the logical order of information hierarchy.

The current 27 Crags UI does not have an overview page for the sectors of the crag. Instead, on every topo page, there is an interactive sector dropdown menu which toggles a listing of all sectors. **Figure 6** shows how the sector listing looks when toggled open. Each sector item is listed along with its name, the number of routes and how many topo images does the sector contain. On this Skevik crag, there exist only two sectors, so the list is rather short and concise. However, if the crag would contain over 20 separate sectors, like is the case in multiple big bouldering areas, this list would be quite long and might not serve the user in their process of finding most interesting routes for them. **Figure 7** shows an example case from Albarracín Crag in Spain which contains over 70 boulder sectors currently.

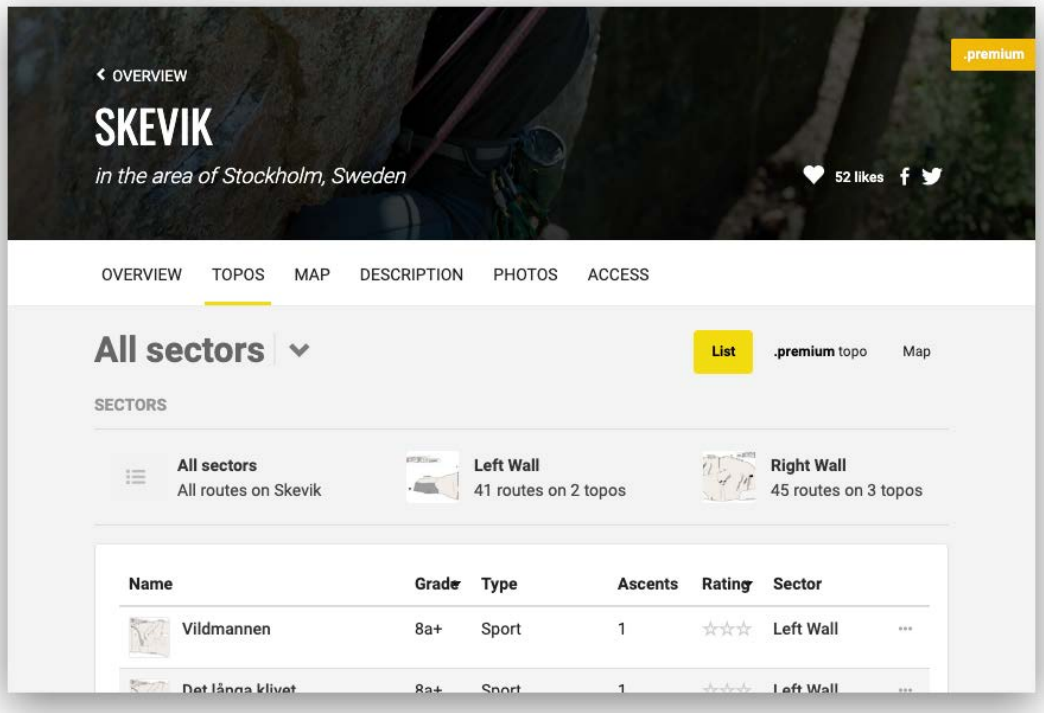

Figure 6: Screenshot from the current web-app showing sectors listing toggled open (27 Crags, no date g). This is the same crag and same page as in the previous figure.

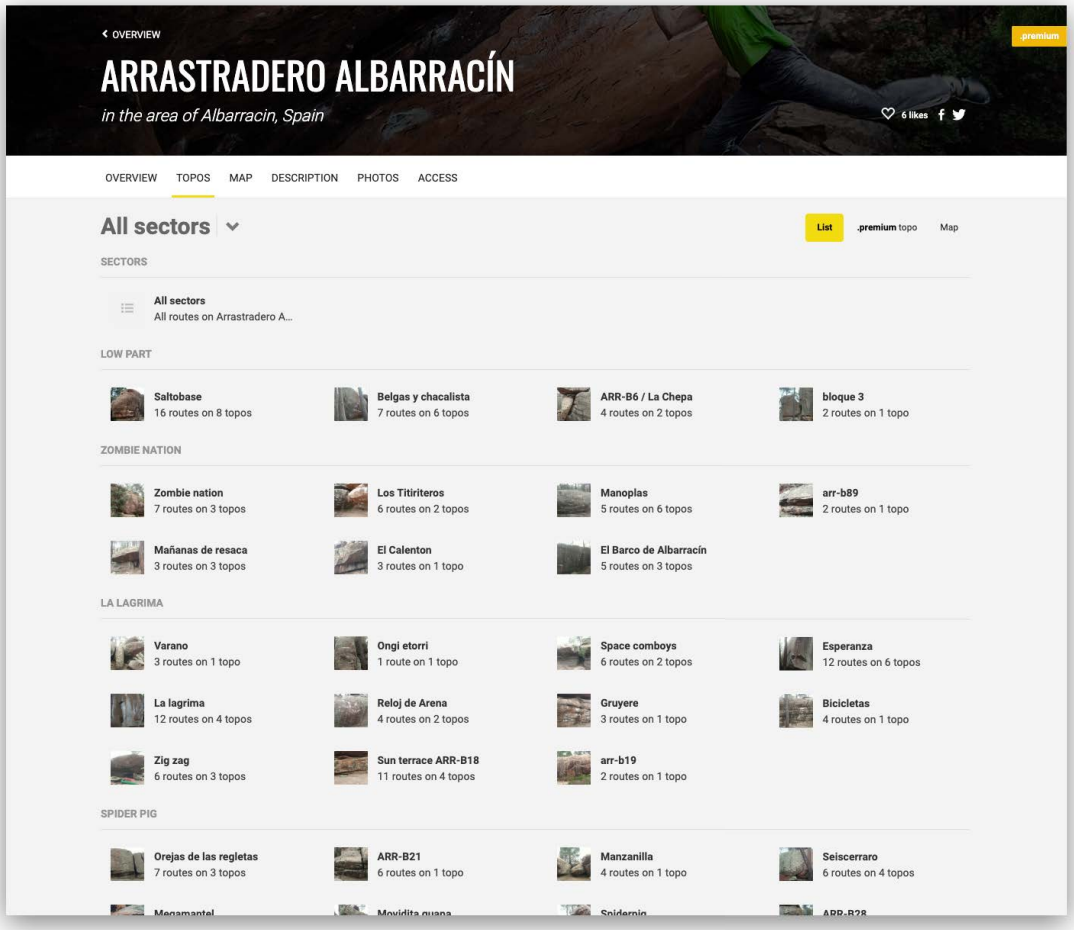

Figure 7: Screenshot from the current web-app showing a list of sectors toggled open on a crag in Albarracín area in Spain (27 Crags, no date c). The crag holds over 70 sectors so the sector listing is long. The topo author has grouped sectors together with named navigation groups.

The 27 Crags topo editor UI allows the topo author to group sectors together to make navigating them easier. **Figure 7** shows an example of a case where the crag contains over 70 sectors and navigation groups are used to group some sectors together. For a user browsing through the sectors, this might be useful so he could know for example which sectors are close to each other. Many users would browse this section while they are climbing at the location and they could be looking up what are the climbs adjacent to their current location.

Chapter 4.2.1 introduces proposals from the later prototype to improve the content hierarchy related problems defined in this subsection.

3.2 Content editing complexity

Being a content-heavy service, there are many types of content that form a topo. **Figure 4** shows a chart of different types of content that a crag entry contains which all need to be editable for the topo author. It is not a simple straightforward task to provide all the tools in the web app UI to provide the optimal editing experience for the content author.

In the current UI, most of the content editing would happen in editing modals. Modal as a term is a shorthand for a modal window where the background is dimmed to guide user focus into the popup window in the front. There is nothing wrong with modals, but they might not suit every situation. Sebastian (2018) argues how modals should only be used in self-contained processes. Simple dialogues requiring a yes or no answer would fulfil this criterion but a modal, which proposes an action to open another modal, would not. In the current UI editing options are often available through a dropdown menu from an edit button located at navigation bar of a topo.

3.3 Graphical potential

Topos are very visual content. Topo as a climbing term originates from *(rock) topography* as in the surface formations of rock or *topographical map of a route* (Lourens, 2005). Originally topos were hand-drawn maps of routes on a rock wall with various symbols representing different rock formations. However, with the rising popularity of digital photographing and flying drones, taking actual pictures of the rock has become ever easier and more popular. Most climbers heading to a boulder or a crag carry a mobile phone equipped with a camera which they can use to take photos of the rock. The popularity of the drones has made it relatively easy to photograph cliffs that situate in a challenging setting for shooting with a normal camera.

There are few limitations with the current implementation of 27 Crags UI concerning the graphical presentation of topo images. It allows using only a modest resolution for topo images. Topo-images in the desktop UI are shown with a fixed width. This makes horizontally aligned topo images appear a lot smaller than vertically aligned images and there is no option to zoom in or make

the image bigger. Often if the photo is taken from far away the route lines in the topo image can be very close to each other which makes it difficult to understand how to routes are aligned on the rock. It is common that route lines share some common sections, but the current web-app does not provide any tools to support such structure. This has made the topo authors draw multiple overlapping lines in the same spot which makes the topo readability worse.

4 Prototypes

The purpose of the prototypes is to come up with quick ideas and learn which concepts could be developed further (Galitz, 2007). Such is the case for prototypes in this project. The first iteration was done with paper prototyping; just simple hand-drawn sketches on paper. The ideas on paper prototypes were discussed with the 27 Crags CEO and the best parts were then refined into higher fidelity interactive prototype, which has its restrictions but mimics the actual web application in its visual style.

4.1 Early paper prototype

Based on the problem areas discussed in chapter 3 the first iteration of enhancing the UI was to draw paper prototypes. Hand-drawn sketches are useful for making early-stage proposals quickly and without large investments to discover what needs to be improved in the next stages of the design process (Galitz, 2007).

Figure 8 presents a paper sketch for crag overview page proposing a couple of new concepts. On the top right corner, there is a *Crag editor* section which contains some controls for managing and editing crag info and is only displayed for users who have editing rights to the current crag. It also proposes an *editing mode*, which toggles between editing function visibility within the page.

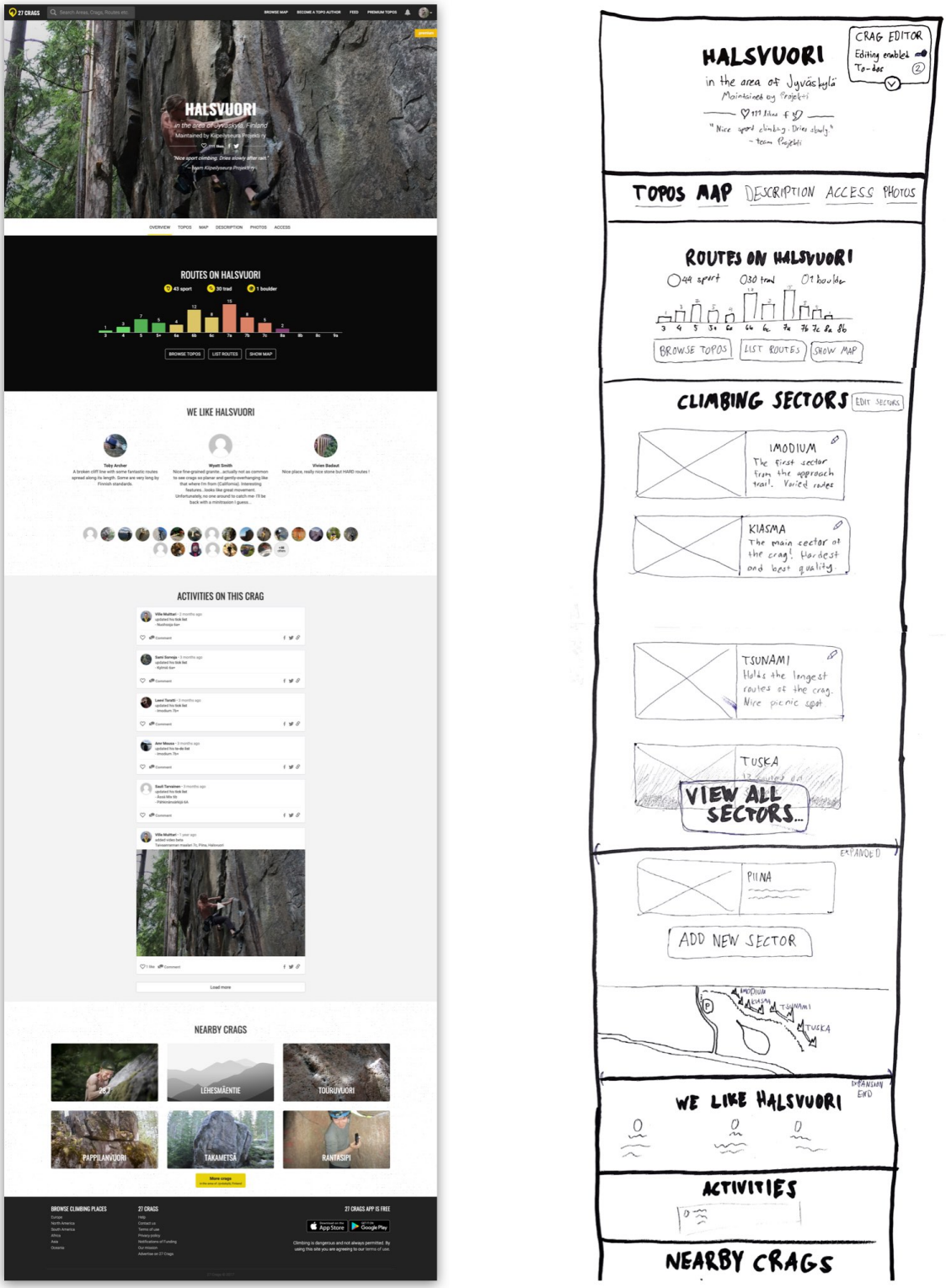

Figure 8: Crag overview page screen capture from the current web-app (27 Crags, no date e) and a paper sketch iteration with UI improvements.

The presented overview page itself does not contain any complicated functionality but editing content further down at topo sections prove to be

complex so to keep the system consistent the editing mode is presented also on this page.

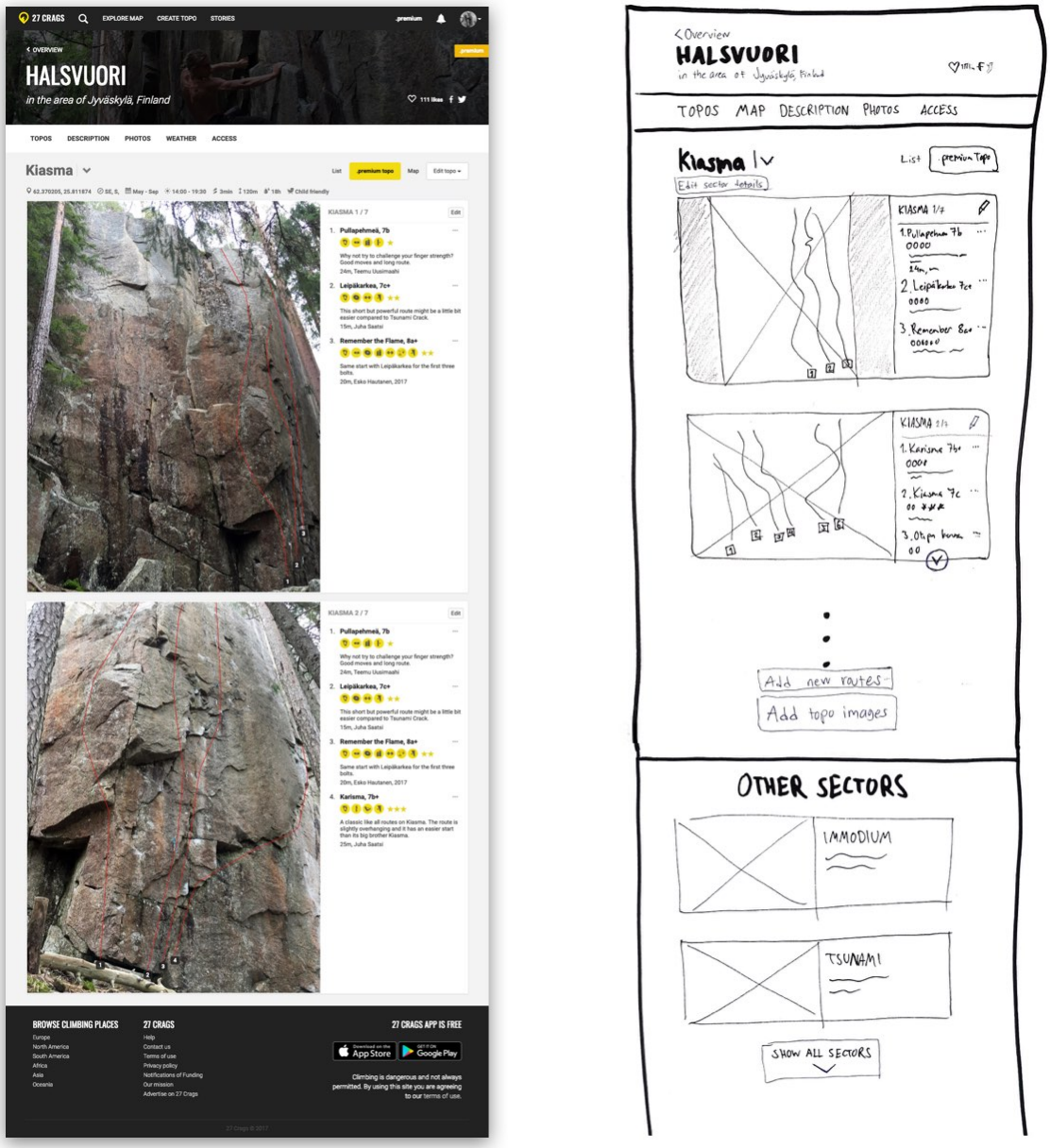

Figure 9: Topo for Kiasma sector from the current web-app (27 Crags, no date e) compared against paper sketch.

The paper prototype was used as a tool for exploring ideas and discovering how features and changes settle in the big picture. Creating the paper prototype required multiple low effort iterations and helped to refine rough ideas into a usable form. Based on the prototype there was a session with the 27 Crags CEO where feature suggestions were presented and evaluated. In the double diamond design process model (Design Council, 2004) this was the closing point for the

first design diamond. The paper prototype was used as a tool to convey the improvement suggestion ideas. What was learned from the paper prototype was used to develop further with the interactive high fidelity prototype.

4.2 Interactive high fidelity prototype

Based on what was learned from the paper prototype the next work phase took place to refine the ideas further into a higher fidelity interactive prototype. The purpose of the next prototype is to make it look and feel more like an actual web app so it can be used to test ideas and concepts on actual users.

The high fidelity prototype was created by drawing pictures on Sketch and then combining different pages with Invision tool. This enabled to create an interactive slide-show that mimic a real web-app UI. It was possible to choose different actions and page changes depending on where the user clicks or holds the mouse cursor.

This section introduces the main changes that the high fidelity prototype proposes to the 27 Crags web-app UI. The changes are divided into subsections by theme.

4.2.1 Content hierarchy and navigation

To address some problems about content hierarchy mentioned in chapter 3.1 few changes were proposed in the high fidelity prototype. The changes aim to make it more comprehensible for the user where they are in the hierarchical structure and guide them better to find the relevant information they are looking for.

The main page of the crag is the first page the user sees when clicking a crag entry on the map or selecting a crag from search results. The page shows general information of the crag, route difficulty grade breakdown chart, what other climbers say of the crag and recent activity. The only visual information about the crag is the hero picture and route difficulty chart. The prototype proposes a new section to the page which could show a peek into three highlighted sectors of the crag, displayed in **Figure 10**. These highlight squares would either show

a promo picture selected by topo author or one of the topo pictures of the sector. Hovering with a cursor on top of the image would dim the photo and show a diagram of route grades on the sector and the number of routes within each climbing discipline. Clicking the sector would take to the topo of the sector.

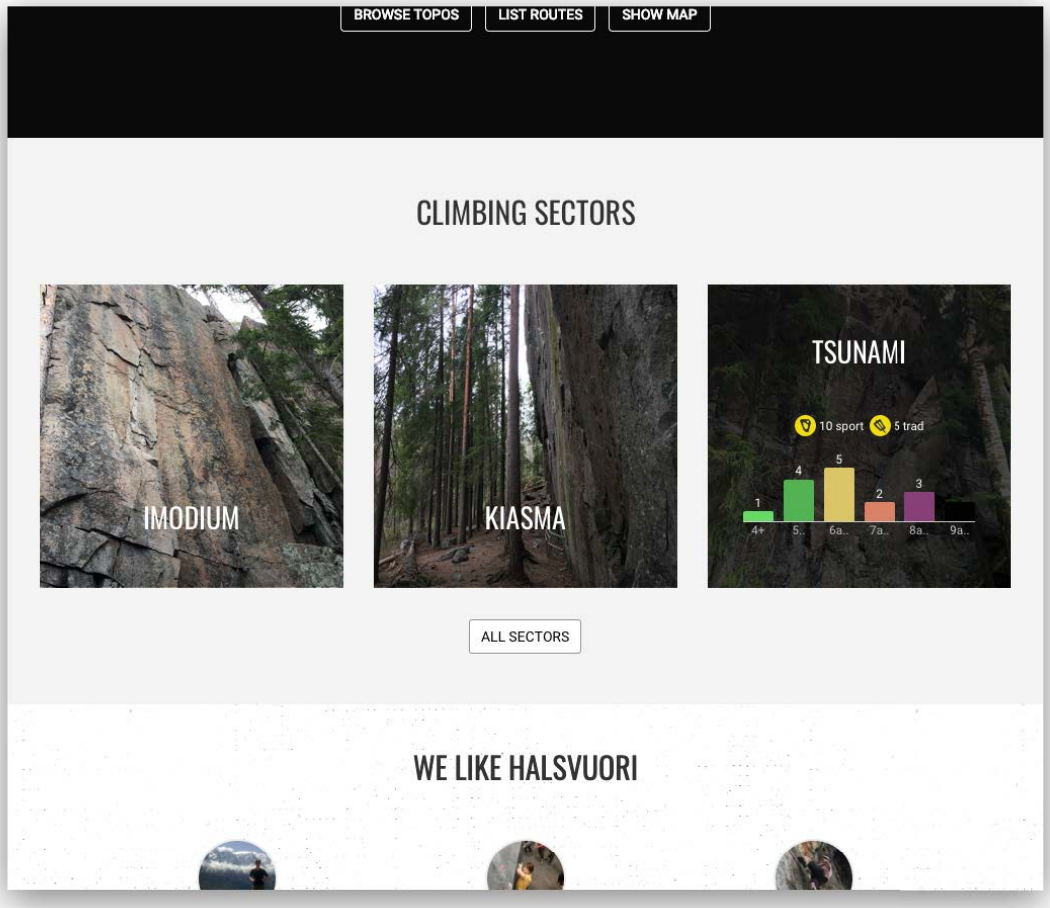

Figure 10: New section *climbing sectors* for the crag overview page shows three sector-highlights from the crag in a visual way. The cursor is hovering above the third *Tsunami* sector revealing the hover effect and diagram of its routes.

The next intervention for browsing is a new view for showing an overview of all climbing sectors of the crag displayed in **Figure 11**. Hierarchically all climbing routes belong to a climbing sector but there was no dedicated view for conveying an overview of all sectors. In the current implementation the only ways to view all sectors is to either look through the map view how different boulders and sectors are aligned (see **Figure 2**) or through the drop-down listing of sectors on sector topo page (see figures **6** and **7**). This sectors overview is also the user

when navigation item *topos* is clicked as opposed to showing a listing of all routes of the crag (see **Figure 5**).

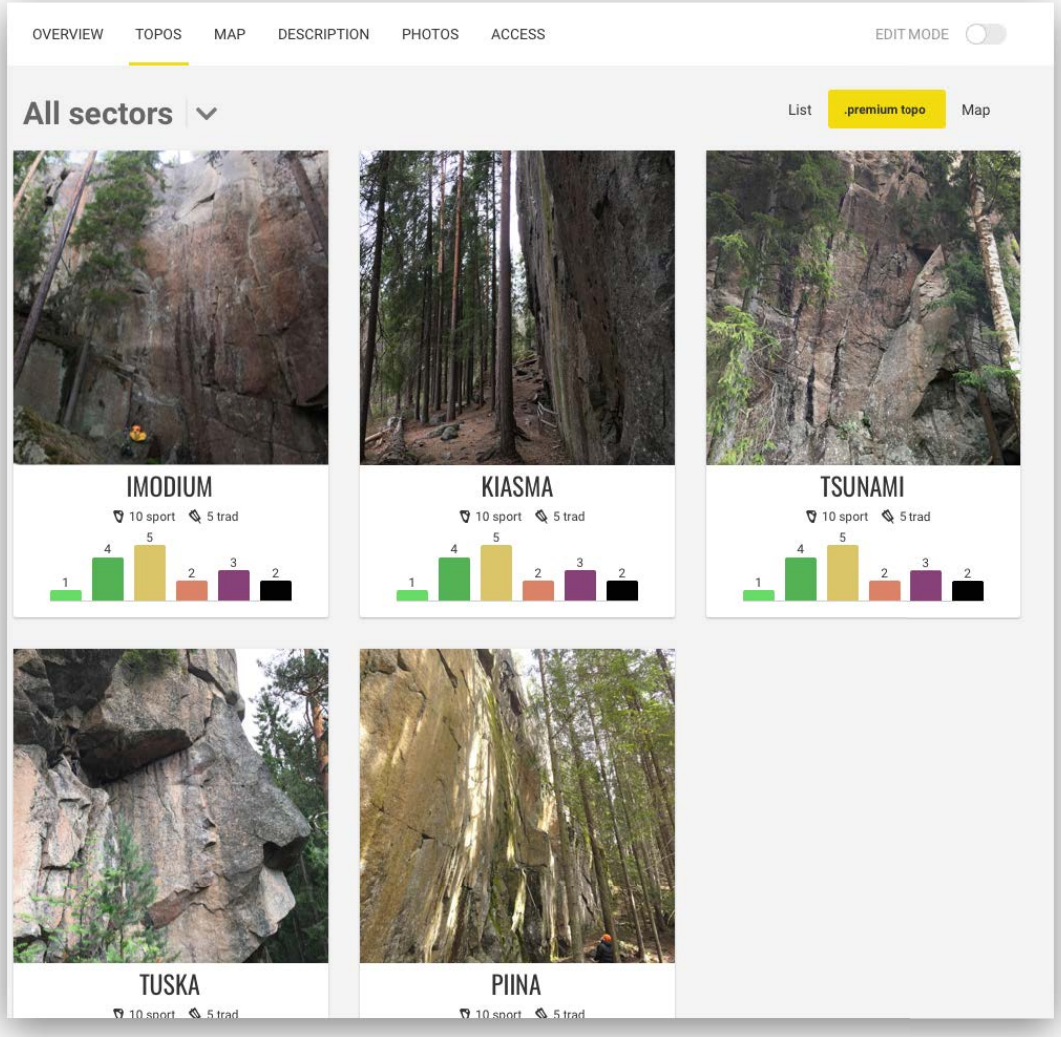

Figure 11: Sectors overview is a new view which is shown to the user when the navigation bar item *topos* is clicked.

The sectors overview page shows a picture and route style and difficulty breakdown for each sector. It is typical that climbers enjoy the challenge and have a preference to seek out climbs which are at a specific difficulty grade. In the current web-app, there is no view that would at a glance show the user how are the route difficulties distributed between sectors. One of the major factor determining difficulty is the angle of the rock which often changes between different sectors. Thus, it is common that climbs in similar difficulty grade range are in the same sector and the climbing style varies more between different

sectors than within a sector. Due to these reasons, this graphical presentation of differences between sectors would probably make it easier for the climber to find interesting climbs for them.

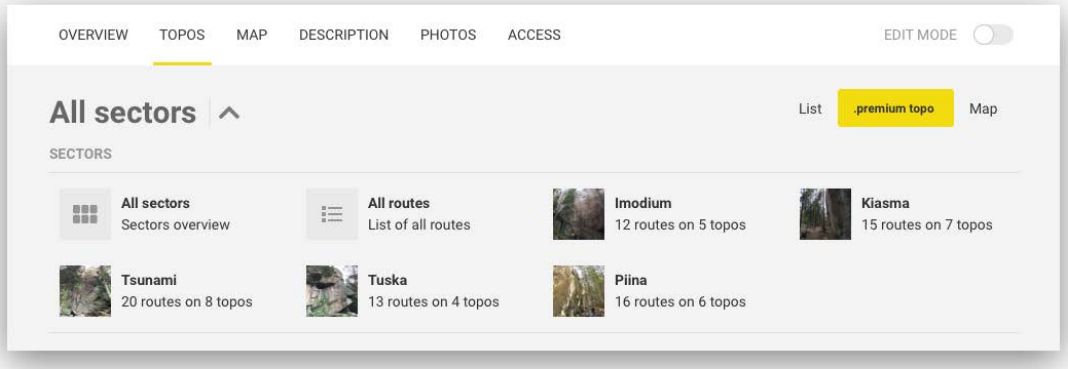

Figure 12: The dropdown sector selector has a new item All sectors. This takes the user to the sectors overview page.

The sectors overview page is meant to coexist with the all routes view. **Figure 12** shows how the first item on the listing is a link to the sectors overview but the following item takes the user to the all routes view.

Once the user heads from the sectors overview page towards a view that shows a topo for the sector the user has advanced one level deeper in the content hierarchy. In the current implementation, the only way to navigate to adjacent sector topos was to use the sector dropdown listing which is at the top of the page. This control is labelled with the sector name and has a chevron icon pointing downwards and might not be obvious for the user that it reveals other sectors. If the user is browsing through the topo it might also make sense to have navigation controls at the bottom of the page instead of forcing the user to scroll back to the top.

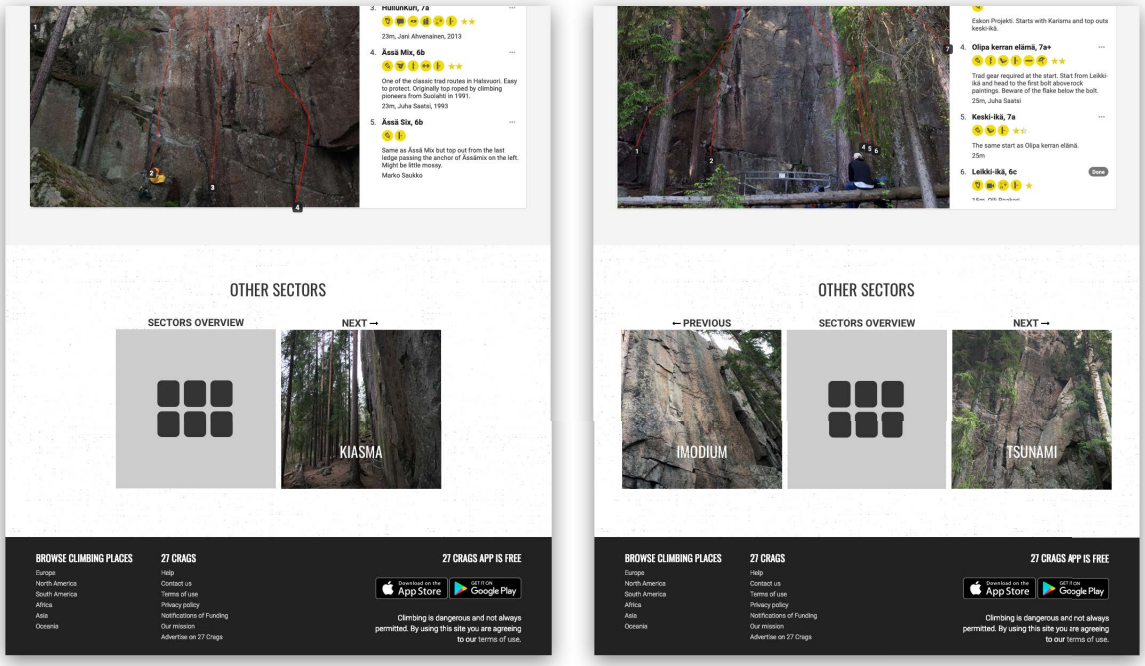

Figure 13: Topo page for a sector shows navigation controls at the bottom for adjacent sectors and back to the sectors overview page. The figure shows how the first sector does not have navigation to the previous sector while the following sector has.

To ease the user to navigate within the sector topo level a navigation section was proposed in the prototype. **Figure 13** shows how the new section looks at the bottom of a sector topo. It was labelled as “Other sectors” and it shows picture links to previous and next sectors as well as a link back to the sectors overview in the middle.

The user testing findings on these features are discussed in chapter 5.2.1.

4.2.2 Topo image zooming

The current web-app implementation shows topo images at a fixed width in the UI. This behaviour means that horizontally aligned images get less screen estate than vertically aligned images. This often results in a situation where the route lines on the image are very close to each other making it hard to comprehend and differentiate how routes are aligned and how are they separated. When the topo image is taken from a far distance this becomes worse. To prevent topo images becoming too small users may need to crop their photos or split them into multiple images so the image becomes vertically aligned and becomes bigger on the page.

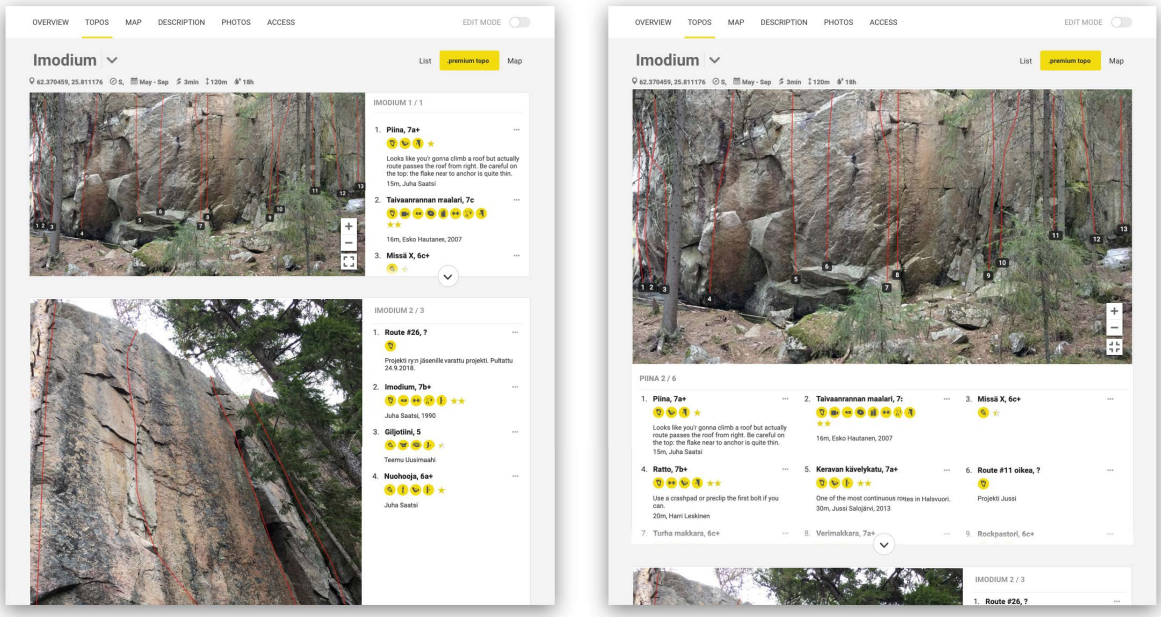

Figure 14: Hovering on a topo image will show zooming controls at the bottom right corner of the image. Clicking on the lowest of the control opens the image into a wide view and drops the route listing below the image.

The prototype, however, proposes that the topo image could have zooming controls and an option to make the image full width as shown in **Figure 14**. This allows the user to zoom in to the pictures. The change into the wide view would happen instantly without a page load possibly with a smooth animation.

4.2.3 Edit mode

The prototype proposes a universal edit mode which is always shown on the right-hand side of the navigation bar on each page. It is only visible for users who have editing rights. The purpose of the edit mode is to unclutter the UI by removing controls which are not relevant for the user at each situation. When the topo author wants to edit the topo they most likely are not interested in logging their ascents for example. In the current web-app implementation the complex editing functionality is hidden behind dropdown menus and modals. Using a dedicated edit mode would allow bringing editing controls visible and more easily accessible to the user.

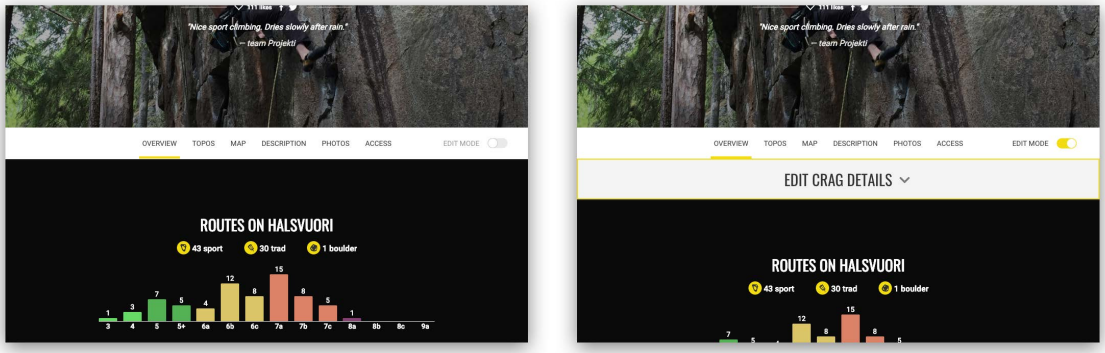

Figure 15: Toggling the edit mode toggle on the right side of the navigation bar will make editing controls visible. The edit mode is toggled off for the left image and on for the right image. The figure shows how control for editing crag details becomes visible right under the navigation bar.

The editing functionality is kept consistent by having an edit section for current page always beneath the navigation bar. This becomes visible once edit mode is activated as shown in **Figure 15**. The edit section related to the current page can be toggled open like an accordion as shown in **Figure 16**. By keeping the location consistent for this edit section it is easy to discover and access on every page like shown in figures **17** and **18.**

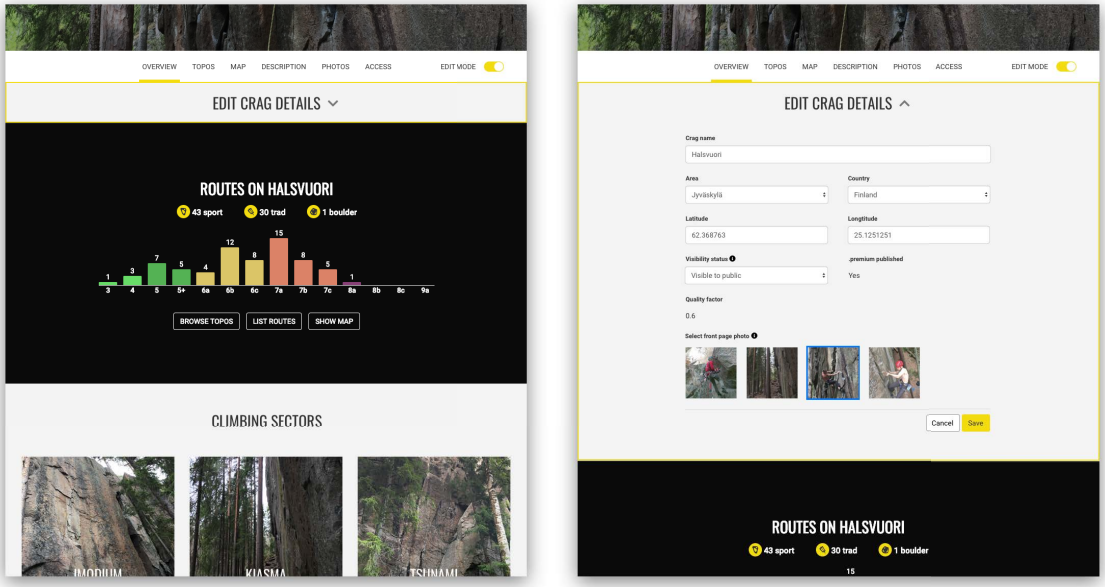

Figure 16: Clicking on the crag details editing button will open the accordion on the same page.

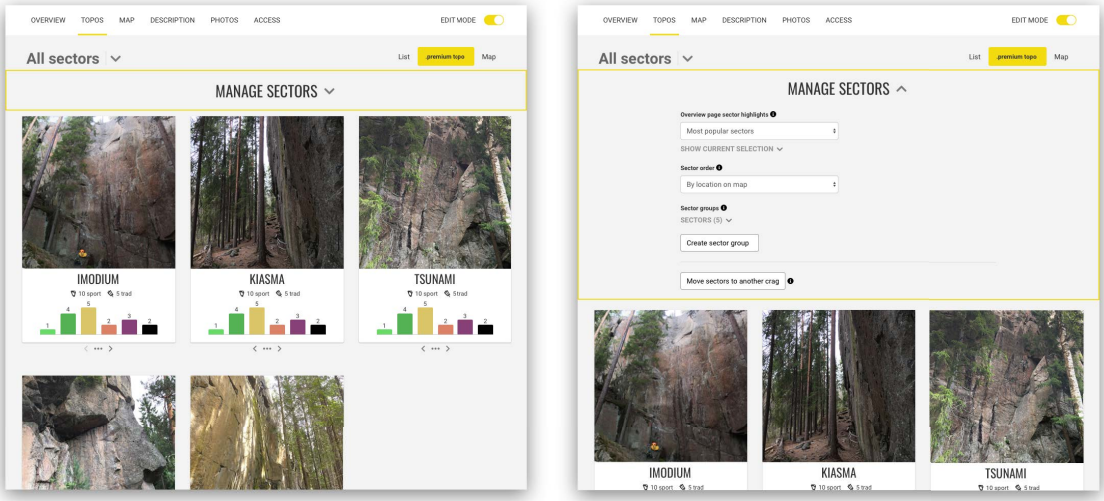

Figure 17: Managing sector order can be done on the sector overview page edit section.

The edit mode may also toggle other edit controls than the edit section below the navigation bar. Sector edit controls become visible on the sectors overview page below each sector item, shown in **Figure 17**. The chevrons to left or right changes the order to the corresponding direction and the three dots toggle visibility for a popup menu for more special edit actions on the sector.

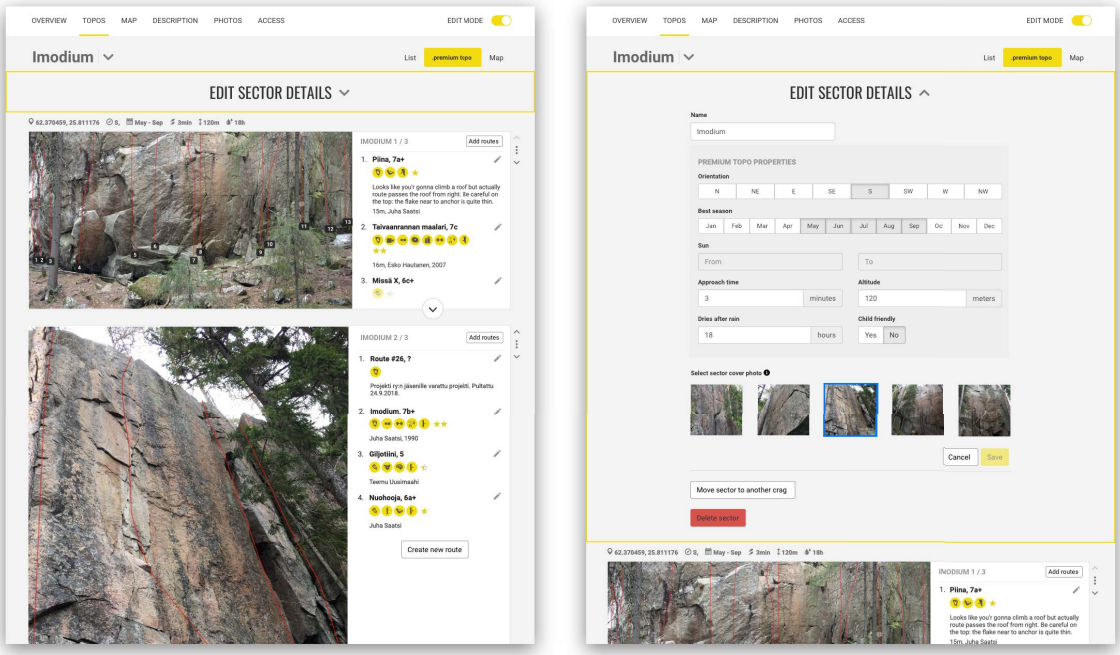

Figure 18: Following the convention of having edit controls for the content of the current view, the sector details can be edited by opening the editing accordion.

The sector edit page has many new editing controls becoming visible in edit mode. As shown in **Figure 18** the sector-specific edits are again visible in this

section. As shown in **Figure 19**, on the right side of each topo image similar chevron and three-dot icon control appear similarly as in the sectors overview page had beneath each sector item. Correspondingly the chevron arrows allow changing the order of the images and the three-dots show a popup menu for other actions. A button “add routes” is at the heading of each route listing for adding more routes to the topo image. After the last topo image, there is a button for adding more images.

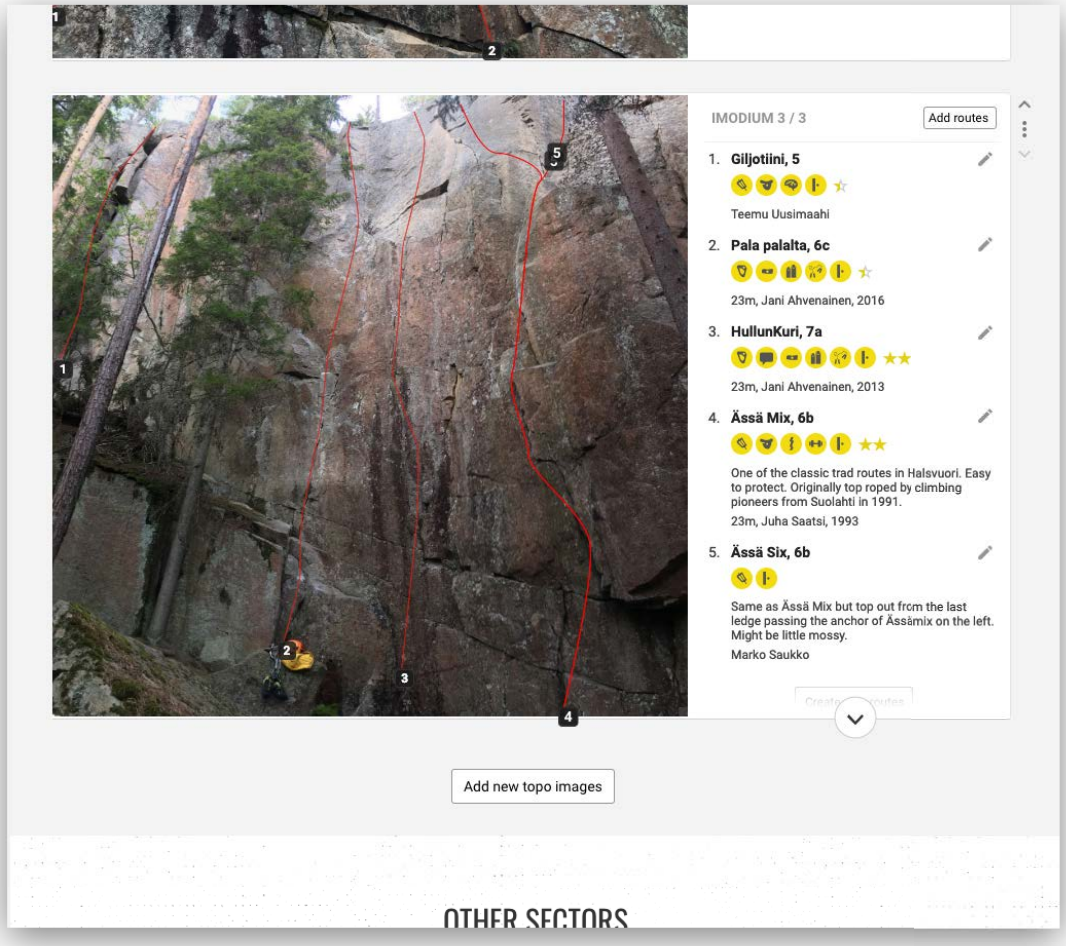

Figure 19: Sector topo page shows many new editing controls in edit mode.

Each route in the listing hides the three dots control that is used for logging accomplished routes as this is a feature that is not needed while editing a topo and instead there is a pencil icon indicating that route editing can be accessed here. **Figure 20** shows how toggling a route editing mode dims other routes in the list and shows new controls for editing the selected route. Clicking on the

“draw” button here will show route drawing modal which is presented in more detail in the next subsection 4.2.4.

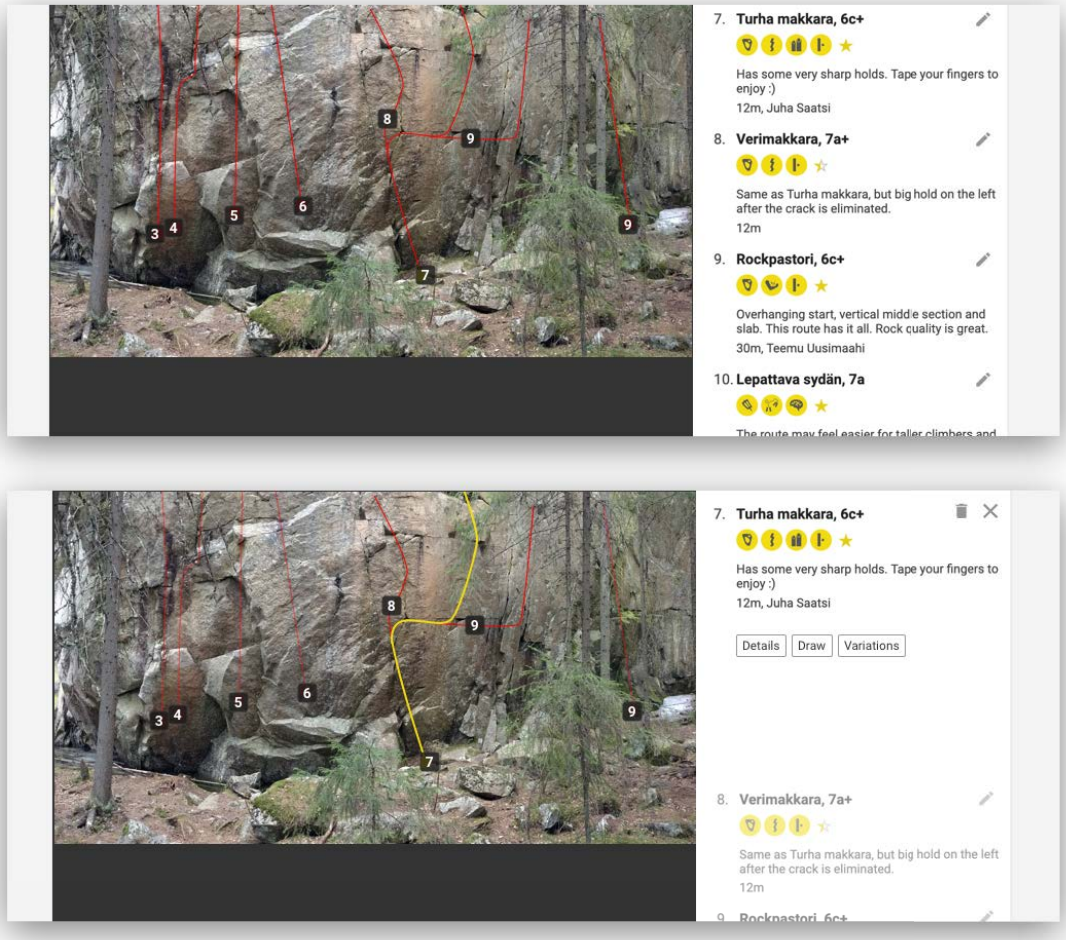

Figure 20: Edit mode allows the topo author to open editing controls for a route in the route listing. Clicking on the pencil icon for route seven on the image above makes the route editing controls visible as shown in the lower image.

4.2.4 Drawing routes

The current web-app route drawing functionality is very basic but simple. The prototype proposes multiple new functions to be part of the drawing tool. **Figure 21** shows how the bottom row has buttons for different actions of the drawing tool: redraw the route, add hazards on the image, add anchor or create variation. The following **Figure 22** shows user flow for drawing an anchor. Figures **23**, **24** and **25** show different scenarios of drawing route variations which have common sections with an existing route. The route variation drawing functionality enables the topo pictures to be drawn in a cleaner way as there is less need for

overlapping route lines on the image. In **Figure 20** it is visible how routes 7, 8 and 9 share a common start but the route lines are drawn in a clever way to show only how the routes diverge amongst each other.

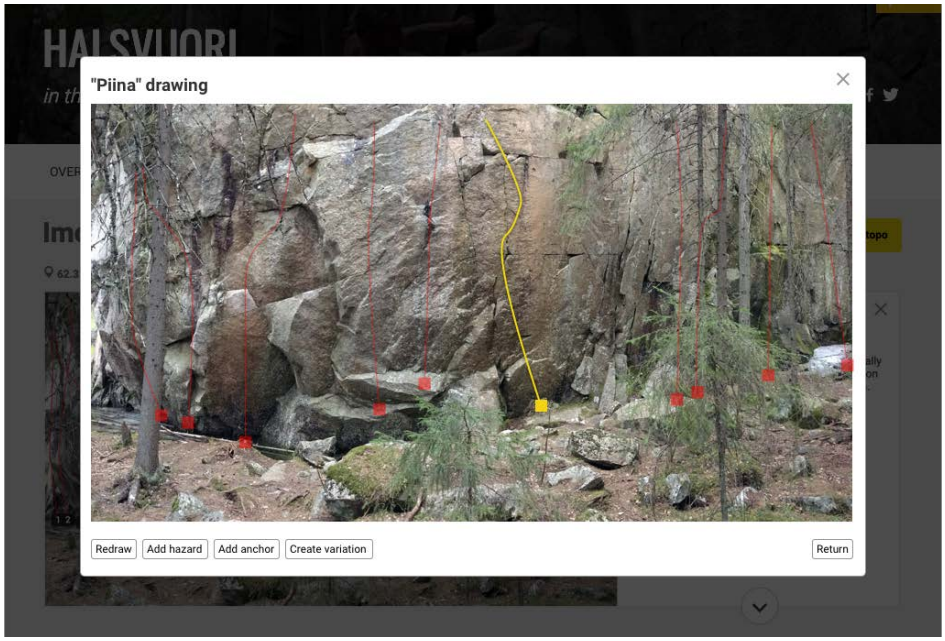

Figure 21: Route drawing modal window has multiple actions shown on the bottom row.

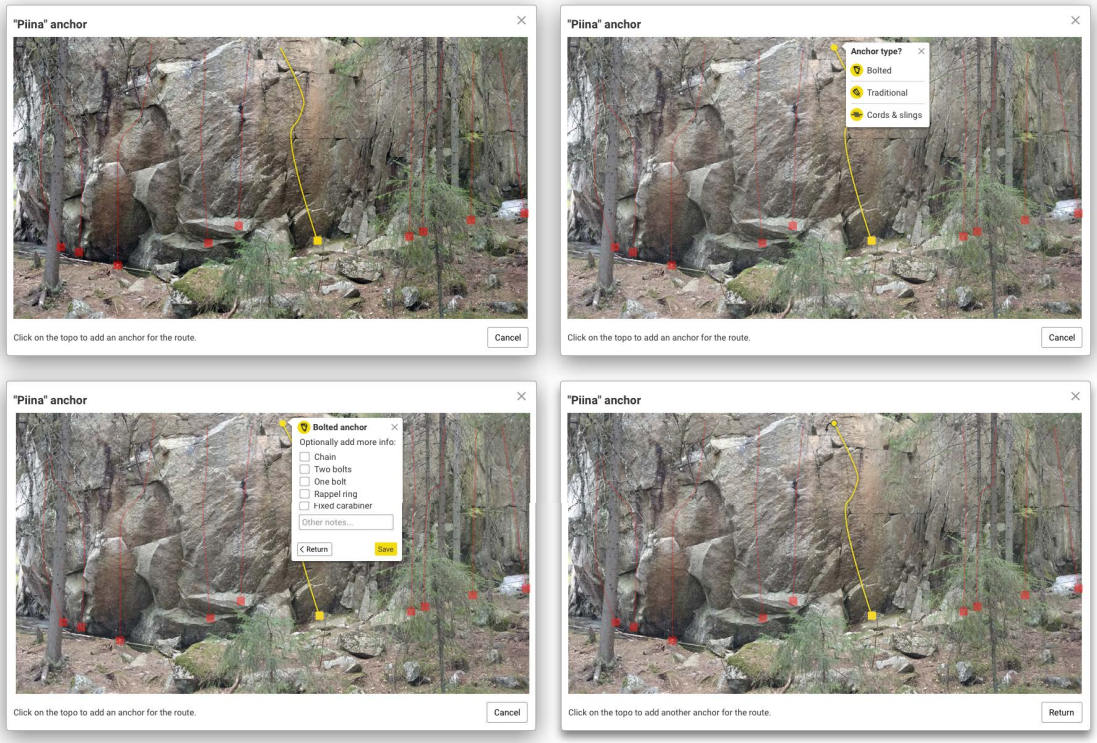

Figure 22: Drawing an anchor for a route. This four-screen flow should be read from left to right. Clicking at the anchor position on the first screen pops up a small dialogue bubble asking about the type of anchor. On the next screen, the author may enter more info.

Figure 23: User flow drawing a route variation of the existing route where the variation shares the same start but different ending. On the first screen, the user clicks on the route start. Next user clicks midway to the existing route but on the third screen, the user clicks to the right as the variation diverges.

Figure 24: User flow for drawing a variation of the existing route. The variation is identical to the existing route apart from the higher start. Such a scenario is very common in bouldering where the same route could have multiple variations with different starting positions. Starting to draw variation by clicking from the middle of the existing route pops up a dialogue asking what was the intention of the author.

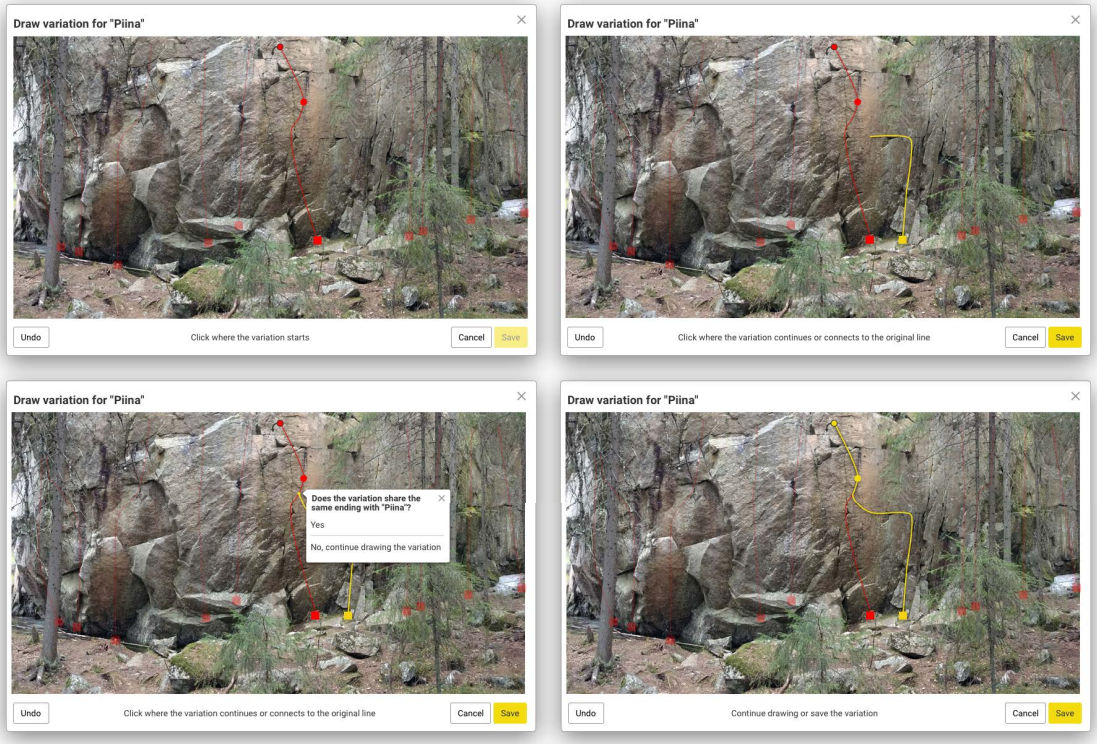

Figure 25: User flow for drawing a route variation with a different start but same ending with the existing route. On the third screen, a small dialogue pops up to ask whether the user wanted the variation line to merge with the existing route for the ending. The last screen shows the result of an affirmative answer as the tool automatically followed the existing route towards its end.

At the core of the interaction flow for the drawing tool are two elements: the instruction text on the bottom updates according to each situation and when user advances to a complex situation a small popup dialogue appears where the user had clicked and asks what the intention of the user was. This way the UI can be kept simple, but the user is able to achieve more.

5 User study and testing

The previously presented prototypes aim to convey some ideas and concepts which were created to enhance content creation experience for topo creators and topo browsing experience of for climbers using the app. Then some user study testing was done to gather user feedback for the visual designs. Nielsen (1993) argues how iterative user interface design methods and user studies between iterations would very likely yield positive results on the design outcome.

The main themes for what problems the visual prototypes might solve are the following:

1. Making it easier to organize, edit and manage topo content for the topo creators.
2. Making it easier to navigate and view topos for a climber.

The first theme may be more important if we compare these themes against our research questions defined in the first chapter. Making it easier to organize, edit and manage topo content was the main motive for improving the app UI. The second theme happened as a by-product of enhancing the topo creator use experience. Making the content hierarchy more visible and easier to manage also probably made it easier to view and navigate the content.

5.1 Methods

5.1.1 Participants

To gather feedback for both themes the prototypes improve we need to recognize the criteria for what users should we conduct the tests with. The first theme is relevant to the user experience of topo authors who are very experts in using the app. The second theme is relevant to normal climbers who might vary in their experience of using the app. The user target group for testing the first theme will be called as the primary target group and the test users for the second theme will be called as the secondary target group.

As the main target group test users were needed with a criterion of prior experience of using the content creation section of the app. 27 Crags team provided a list of three topo authors who could be contacted for testing with the prototype. All three accepted the invitation for a testing session. The tests were conducted through video calls due to all subjects being abroad during the time of testing. Having more participants would have been beneficial to provide more proof for the findings the current number was good enough for initial findings.

All three people of the main target group testing were adults in the age group approximately between 25 to 40. They were all passionate climbers with over a decade of climbing experience. Everyone had used 27 Crags first as a climber and later they got more involved with 27 Crags operations and eventually ended up creating lots of topos on the platform. Important notice is that even if the users are somehow affiliated with 27 Crags company none of them had a technical role for building or developing the web service, but their role was more about using the platform for creating content. **Table 1** shows a comparison of topo authors' background.

Table 1: Participant backgrounds for topo authors, the main target group.

	Author A	Author B	Author C
Climbing experience	Approx. 10 years	Approx. 10 years	Approx. 11 years
Affiliation with 27 Crags	Works for 27 Crags	Has worked for 27 Crags but now only part-time	Creates topos and receives some salary for it
Topo creation experience	Creates lots of topos and helps other topo authors to succeed in creating and maintaining topos	Lots of topo creation experience. Has created big crags with over 1000 boulders or over 100 boulders.	Maybe the biggest single topo author. Focuses on bouldering and has created over 10 000 boulder routes on the service.
Interview language	English	Finnish	Finnish

The criteria for the secondary target group, normal climbers, were a prior experience of outdoor rock climbing and usage of 27 Crag app for finding information about outdoor rock destinations they were heading for. To recruit such participants to user testing the thesis author headed to Kiipeilyareena Redi climbing gym at Kalasatama in Helsinki. It is one of the rather big bouldering gyms where climbers head regularly to train on indoor walls. Without any prescheduled meetings it was possible to ask some climbers at the lobby if they would be willing to participate in the study. Four climbers in total (3 males, 1 female) were recruited for user testing. They were all in the age group approximately between 25 to 35 and everyone seemed to have extensive experience of outdoor climbing and using 27 Crags for navigating to boulders or crags. They were all given a protein bar after the test session. **Table 2** shows a comparison of backgrounds for climber test users.

Table 2: Participant background for climbers, the secondary target group.

	Climber A	Climber B	Climber C	Climber D
Climbing experience	Approx. 7 years (3-5 years actively)	Approx. 10 years	Approx. 4-5 years	Approx. 7 years
Outdoor climbing experience	Sport climbing on vacation trips, occasional bouldering in Finland	Sport climbing, trad climbing, bouldering.	Sport climbing, trad climbing, bouldering.	Sport climbing, trad climbing, bouldering.
27 Crags use	Has used the service for over five years. Premium subscriber for few years.	Uses a lot especially in Finland. Premium subscriber.	Uses a lot especially in Finland.	Has used the service for around five years. Uses a lot especially in Finland.
Interview language	Finnish	Finnish	Finnish	Finnish

5.1.2 Interview setting and questions

The user interview is conducted in a semi-structured way and split into three sections: discussing user background with 27 Crags, walking through the prototype and gathering user feedback. In-depth interviews are a useful method for obtaining in-depth information from individuals (DiCicco-Bloom and Crabtree, 2006). The questions are formatted to be short and easy to understand like Codó (2009) recommends.

Table 3: User interview structure and questions for topo authors

User background
1. How long have you been climbing as a hobby? 2. What is your background with 27 Crags? (familiarity) 3. How much experience do have creating and updating content on 27 Crags? • When was the last time you created content on the service? 4. Can you recall any challenges or frustrations with the service?
Prototype walkthrough
The participant navigates through different sections of the Invision prototypes. During using the prototypes questions were asked of each section: how did they feel about this feature, was it easy to understand and did they find it useful?
User feedback
1. Would you imagine that most people would learn to use the website very quickly? 2. Do you feel this is an improvement over the current website?

Table 3 shows a rough interview structure for the topo authors, the main target group. The questions in the first section serve as an introductory part to get an understanding of how acquainted the user is with the service. Riihiaho (2015) recommends letting a test user get a chance to relax and ease into the situation to make them comfortable in the situation. Answering several questions about themselves and their background with 27 Crags should be relatively easy to answer.

The first question in the last section, user feedback, is selected from a positive System Usability Scale (SUS) (Sauro and Lewis, 2011) which is based on the original SUS (Brooke, 1996). Both the original SUS and positive adaptation of it were originally intended to be used as a questionnaire for a usability test so using only three out of the original ten questions mean this is just an adaptation interview version of the original proposal. Also, this test setting is not strict usability testing so original SUS might not have been either way be suitable for this purpose.

The second question for user feedback section was selected to gather direct feedback on whether the proposals of the advanced prototype bring any actual benefit. This is directly related to the research question (*RQ2)* defined in chapter 1.2.

The reason for picking only several questions is that the interviews need to be kept short due to the difficulty of finding suitable subjects willing to spend lots of time with the interview.

As the test is done with two different user groups with slightly different goals the test structure and questions are also slightly modified. **Table 4** shows the modified interview structure for the secondary target group, normal climbers who use 27 Crags service mainly for browsing topos.

Table 4: Interview structure for climbers, the secondary target group. This table is slightly modified from the previous table.

User background
1. How long have you been climbing as a hobby? 2. How much do you have experience climbing outdoors and what disciplines? 3. How long have you used 27 Crags?
Prototype walkthrough
The participant navigates through sections of the prototype which are relevant for browsing content: sector highlights on the main page, sectors overview page, navigation to adjacent sectors and topo picture zooming.

User feedback
1. Do you feel this is an improvement over the current website?

5.2 Findings

The findings from the performed user tests are roughly divided into three subsections: browsing of topos, editing topos and comparing results against research questions.

5.2.1 Browsing topos

For a normal climber who mainly browses topos, the biggest changes are new sections which help the user to navigate the topo and have a better sense of where they are currently located. This section compares test users' (climbers and topo authors) opinion on different sections of the prototype which were changed to lower the sense complexity of the content hierarchy and make navigation more intuitive. This sub-chapter discusses what was discovered and verified about prototype sections discussed in chapter 4.2.1 through user testing.

Figure 10 displays the new section on the crag main page which shows three sector-highlights of the crag. Most of the test participant liked this addition. Three out of four climbers who mainly browse topos found this easy to understand and useful. One of them said "*This is really nice. Usually, it is difficult to find the [interesting] sector… It's [sector navigation] only in the dropdown menu which is rather difficult.*" The fourth climber had no opinion whether it is nice or not. Two out of three topo authors also found out this view was useful. *"Each [bouldering] area has few boulders which are classics […] Clearly [this] would be useful."* The third topo author did not directly express their opinion on this feature as the interview conversation naturally trod forward.

The button below sector highlights is labelled as "all sectors". Test users had mixed opinions on what would happen when clicking the button. Some said that the remaining sectors would appear on the same page below the three sector-

highlights, but others guessed that they could view all sectors. Either the button label could be improved, or the functionality could be refined.

Figure 11 shows the new sectors overview page of the prototype. Three out of four climbers in the user tests thought that the sector overview page was simple to understand and made it easier to navigate into sections of the topo that they were interested in. The fourth climber, however, did not have much of an opinion if the sector overview view was better or worse than what is the current implementation – a long listing of routes on all sectors. He said that he is only interested in finding the few classic climbs of the whole crag in his grade range and the listing is the most efficient way to discover them.

This is interesting as climbers may have different motives and goals when they read a topo. Some climbers may be interested only in climbing only a couple of routes in a difficulty right at their limit while others may like to get climb lots of different routes with relative ease at their first attempt. The listing for all routes of the crag seems to suit better climbers who have a goal to find only a couple popular classic routes of the crag. However, based on the positive feedback for sectors overview page many climbers may come to the crag with a group of friends who may enjoy climbs in different difficulty levels so it would make sense to head to a sector that has enjoyable climbs for everyone in the group. For this purpose, the sectors overview page allows the climber to quickly understand the differences between different sectors.

The topo authors had mixed opinions on the sector overview page. Most did find this view useful at the scenario of the prototype as the crag contains only five different climbing sectors which are physically aligned next to each other on the same continuing cliff face. Most authors were curious how would the same page look when the crag would contain 20 or 80 separate boulder entries and what would be a sane way of presenting them as a listing? The proposed design would need some adjustments and features to accommodate a satisfying presentation style for displaying that many sectors. Having an option to sort and filter sectors according to some user-selectable criteria could be one solution for this.

One of the authors, however, enjoyed this view of sectors overview. They had found it confusing as in the current implementation the user ends up on a list of

all routes of the crag or to the topo view of the first sector depending on which link they clicked and whether the crag has premium status or not. The author said that the first sector then contained a couple of topo images, but it left the user wonder where the remaining 60 routes are until finally, the user found the dropdown for navigating to other sectors of the crag.

As the last navigation-related intervention is the navigation buttons at the bottom of each sector when browsing topos, as shown in **Figure 13**. This feature was also well received among the test climbers. One climber said, "Yes, it helps navigation, especially if these are, like, in the right order." Another climber said that this section could be captioned to indicate better that these sectors are on the same crag and not somewhere nearby. While all climbers liked this feature, many asked if the sectors are in the right order.

Two out of three topo authors said positive things of the navigation to next and previous sectors. While it was easy to understand where the user may end up when clicking the items some topo authors argued that this kind of previous and next listing is too restrictive as seldom all sectors are next to each other in a straight line. It seems like although the navigations were labelled as previous and next, many comprehended as it would have meant sectors to the left or right when facing towards a cliff face. Many users, however, seemed to understand that this would follow a similar sector listing order as is the case with the all sectors dropdown (**Figure 12**).

The last browsing related change is the possibility to zoom into topo images and open the topo image into a wide view as shown in **Figure 14**. The discoverability of the zooming functions seems lacking as the controls show up only after the user hovers the mouse cursor on top of the topo image. Also, the icon shown for opening the wider view of the topo image proved to be confusing as most test users expected the image to become full screen instead of just a wider view. Despite these flaws, every tester seemed to like the option to be able to zoom into the images. "It's very useful when the picture is taken from far away and the routes are side by side", said one of the topo authors.

5.2.2 Editing topos

This subchapter discusses findings of prototype user testing with the topo authors related to content editing.

The biggest change in topo creation and editing is perhaps the edit mode toggle. This allows the UI to be clear of editing functions when they are needed and when the user wants to make edits the controls can be placed more intuitively and for easier access. Most topo authors said this feature was easy to understand and they enjoyed the simplicity of separating editing mode from normal browsing. One of the authors said they had sometimes made unintentional changes when trying to browse the topo. They had tried to click a boulder in the map view but accidentally the click dragged the boulder into a different location and changed its coordinates. “It is unambiguous that editing controls are hidden and they can be toggled to be visible from here.” Many authors said that the layout of editing controls is more intuitive and easier to find in the edit mode.

The edit sections on each page which open like an accordion down below (see figures **15**, **16**, **17** and **18**) was perceived as nice and logical. Some testers did not see it as a major improvement, but neither did they perceive it as worse than the current functionality with popup menus and modal windows. Having the edit section consistently in the same position on every page made it easy to find.

On the sectors overview page, the edit mode allows the author to manage and organize sectors. The concept for sector groups was not always understood immediately. In the prototype, there is an option to group multiple sectors together to create a sector group. Such grouping could help to bundle sectors close to each other into a group and make it easier to navigate. Partly the confusion with sector groups lie in the semantics: what is a sector and what does it mean for crags and boulders? Some of the authors thought that sector should mean the same that the prototype labels as a sector group: higher-level grouping that holds multiple boulders inside it.

The logic for displaying editing controls next to sector cards (on sectors overview page) or next to topo images (on sector page) was not obvious for the test users. This could be because they were so familiar with the current web-app which

does not have icons for quickly changing the item order while viewing the listing. However, once the controls for changing item order or toggling the popup menu for the item was discussed authors seemed to like this layout as it seemed logical.

Route editing in the prototype seemed obvious and clear for the testers. The authors agreed that there is no need to have control for logging personal ascents when editing topo. It was obvious that the pencil icon will allow editing the route right there in the listing as opposed to the current web-app where the user needs to first navigate to editing routes modal window using a popup dialogue and then selecting the route in another list.

The drawing tool received lots of good feedback from the testers. The prototype allowed the user to create multiple anchors for a route and draw route variations that share common parts with existing routes. Every tester said how the features would be very useful and make the topos easier to understand. The interaction with the drawing tool was easy to understand. The authors know how drawing route topos is problematic in the sense that the topo images become cluttered when multiple route lines share the same start and diverge later. “This really solves some real problems of topos” said one of the authors. “Very nice. It could clean up a lot of messy things [in the topo images].” Another author told “[Variation drawing tool] is really good. [It] clarifies the topos quite well.”

6 Discussion

The research questions were defined in chapter 1.2 as follow:

- **RQ1:** *What parts of 27 Crags web app topo creators struggle with and how could they be improved?*

- **RQ2:** *What user interface design improvements would enhance usability and user experience for rock climbers using 27 Crags web app?*

Chapter 1.2 *Challenges in the current UI* answer partly to RQ1 by discussing some of the problems in the current UI while later chapters about prototypes propose

improvements to fix some of the issues. The performed user test verifies how some proposals in the prototypes worked better and revealed which ideas need further iteration. Overall, it seems the suggestions in the prototype are taking the editing interface in the right direction but further improvement in the design would be necessary to fix problems that were discovered.

As for RQ2, it seems the relatively small changes to the user navigation help climbers to navigate the topos. Every test user had different opinions on what are the problems in the current web-app, but most said that the proposals in the prototype solve some issues they had faced previously.

Overall it seems many of the improvements proposed in the high fidelity prototype were well received and would increase user satisfaction. The feedback from normal climbers who mostly consume content was more positive than the expert topo authors who have lots of experience creating content. The expert users also liked many of the proposals, but they were experienced enough to see some arising issues that would need further iteration to solve.

Still, the biggest problem lies in the field of content-organization; how could the content scale up to accommodate both small crags or boulders and big bouldering areas, and what would be the most satisfying way of presenting the information? The proposed interventions, like having easier access to tools for organizing content or new views to support the user to understand information structure better, aimed to solve some issues. All testers either agreed or partly agreed that the proposed version was better than current, but there were multiple sections that would need further improvements. Many of the test users felt that the proposed changes did not help content organization issues well enough to make browsing a big boulder area satisfying.

The content hierarchy was a subject that came up with almost all expert interviews. It seems the current hierarchy is problematic and maybe should be improved because of the variance between different climbing crags and bouldering areas. By nature, crags or cliffs happen to look quite different than boulder areas and the current content structure may not suit different scenarios as well as it could. Related to the content structure, some experts argued about

semantics how *sector* should mean an area of boulders instead of sector being an alias for boulder entry.

Separating editing functions behind a toggleable mode seemed to make editing content less confusing for the expert editors. The topo authors usually spend a relatively long time in the content creation phase so it makes sense to change UI behaviour so they could be more efficient in the task at their hand: creating and editing content. The content edition is such a complicated task that it makes sense to hide irrelevant features and show editing controls in an easily accessible style while editing.

Some authors complained how creating topos is such a repetitive process and each action requires so many clicks and overall topo creation is a slow process. More effort could have been put into pure usability and efficiency of most important user flows for content creation as this is clearly still a pain point for expert topo authors who create lots of content. It is important to understand that the topo authors may coarsely be divided into two user groups: expert topo authors who create lots of content and local climber enthusiasts who create content for their local crag but are not willing to put too much effort to learn to use the tool efficiently. The editing tool needs to have a balance between efficiency for power users and easy discoverability and learning for new users.

However, it is noteworthy to mention that all topo author test users belong to the power user group. Everyone had a lot of experience creating topos and they know the current UI very thoroughly. To understand how well new topo authors learn and adapt into topo editing UI it would be useful to conduct some testing with topo authors who have just recently created their first topos on the service.

The improved route drawing tool seemed to satisfy all expert editors. Everyone recognized the struggle of how routes share some similar parts with other routes, but current UI does not allow any functionality to support this. An interactive drawing window with a guidance text updating according to the situation was easy to understand and further question toggles enabled the user to handle varied and complex situations in a simple way. The users thought this feature along with route variation editing would unclutter topo pictures with too many lines in a tight space.

This case study did not propose any detailed suggestions to improve the map view, but the controls for map editing would probably benefit having some facelift.

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